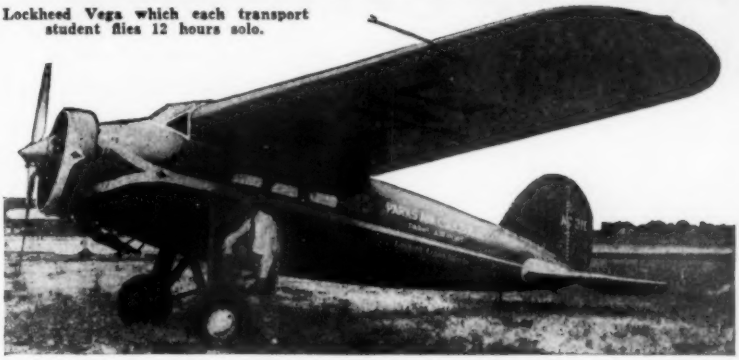
POPULAR AVIATION

Stearman 81
Scale Plans Page 375

DECEMBER 25c
In Canada 30c

1933

Lockheed Vega which each transport student flies 12 hours solo.



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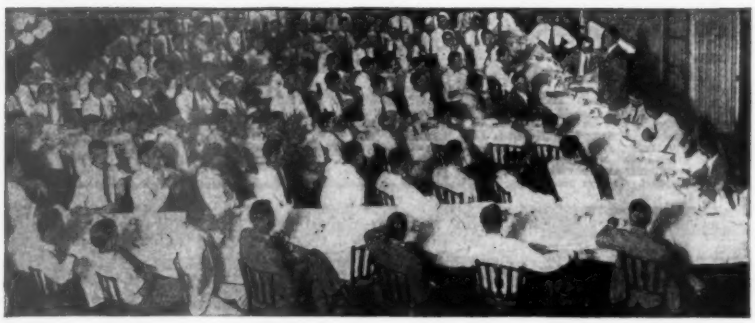

A student's banquet, addressed by the President of the College.

Students on the Parks dormitory portico.

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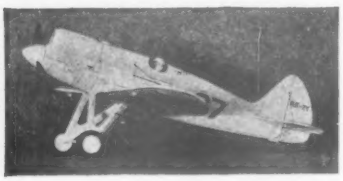

1931 BAYLE'S GEE-BEE

(Re-Designed)

A real beauty. Colored yellow and black. Span 17½", length 12", weight 1.3 oz. Kit SF-17B, only

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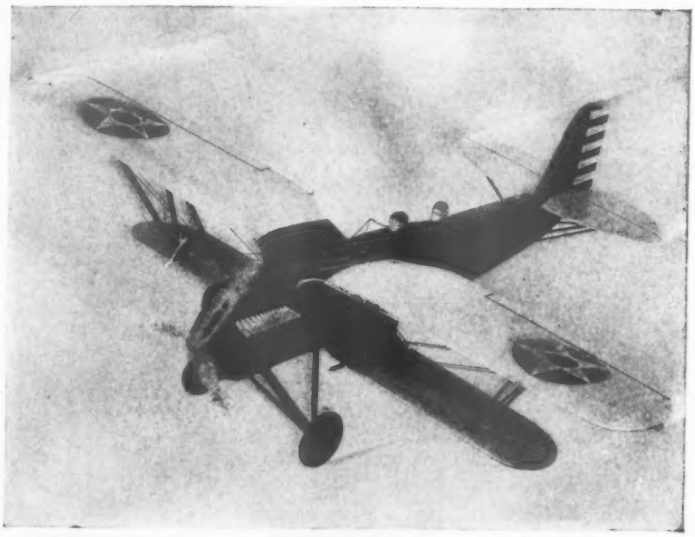

1932 Buhl Bull-Pup

Span 22½", length 15", weight 1.9 oz. Colored yellow and blue, black details. Kit SF-38, only **$1.75**

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Span 20¾", length 14½", weight 2.9 oz. Colored blue and cream, black details. Complete Kit SF-34, only **$2.00**

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ISSUE No. 5 of Cleveland MODEL MAKING NEWS

And Issue No. 6 will be ready soon after November 15th-25c each. Be sure to get both issues—packed with authentic full size drawings, valuable ideas and suggestions every modelmaker needs. Send 50c at once if you wish to receive both copies. Earlier issues still available at 25c per copy. Foreign customers, add 5c per issue to above prices.

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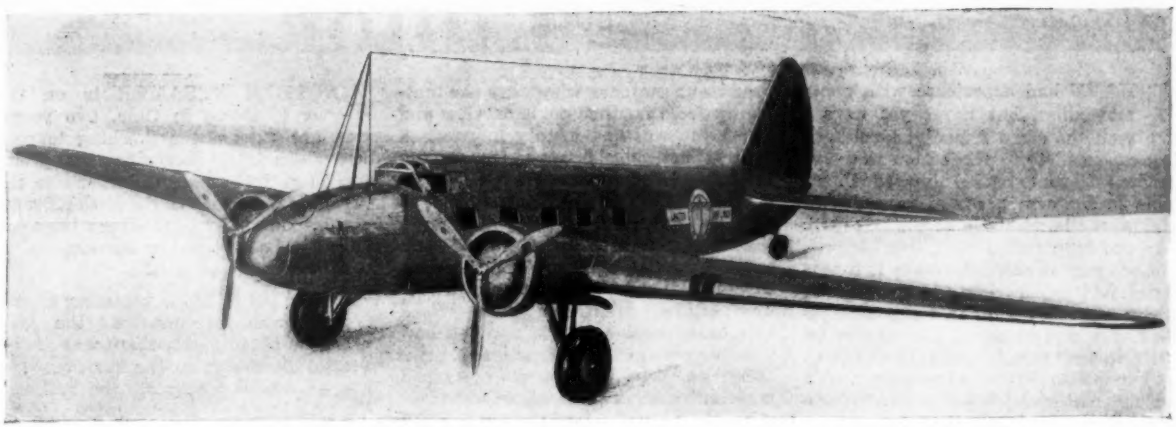

You've Still Time to Build this masterpiece BOEING 247 — and try for that 6,000 mile Prize trip—but hurry. HURRY!

Here is the realization of every model builder's dream—a Kit that will build the kind of a model everyone dreams about, and the possibility of winning a 6,000 mile prize trip with it. What an opportunity! And the only expense is the few dollars the Kit costs. Imagine! Why, no model builder deserving the name can afford to pass up such a chance—think of the prize at stake. Even if you don't win first prize in the great Popular Aviation Boeing contest, you still have a crack at 19 other prizes. The very joy and thrill of building this marvelous almost 5-foot-span Cleveland-Designed model is something you'll never forget—yet on top of that it may win you a prize that will be the envy of every modelbuilder in America. Even if it means asking for your Christmas present now —don't hesitate doing it. Never again may a model mean so much to you. Think of the adventure of building it—and the thrill of entering it for a 6,000 mile trip prize. Decide right now to get it—put your best efforts into the building—and go after one of those grea prizes—you may be the lucky one.

EVERYBODY'S TALKING ABOUT THIS GREAT KIT

The big Boeing 247 itself is such a sensation, that an authentic flying miniature of it (as the case with all C-D models) was bound to set the model world agog. And the fact that it's such a large model (55⅝" span) gives it a realism that makes every one marvel. What a beauty

It just "Slices" through the air with all the sweep and beauty of the big plane.

—and what a fascinating model to build. Yet its similarity to its prototype doesn't end with looks—no sir she flies with that swift, sweeping air master;" so distinctive with the original. We conducted flight tests on Cleveland's proving ground and easily obtained hops of over 250 feet—at an altitude of 40 feet. And high in the air (except for the fact that its wheels do not retract due to rubber motors being so low in the wings) it looked like a dead-ringer for the big ship.

Powered with rubber strands, and made in the orthodox C-D manner (except for the larger structural members such as wing beams which are of the built-up girder type) and generally of balsa, paper, music wire, and furnished with a large quantity of standard Cleveland dopes and cements. Motor sticks are removable, so when displayed, it looks like an exhibition model —just the thing for the Popular Aviation contest.

Kit Contains Everything Needed

The Kit comes complete for a flying or exhibition model with all material necessary, including partly finished nose block, ready furnished cowls, completed "bronze bushed" two piece authentic balsa wheels, stout axle material to withstand the severe landing shocks, all the dopes necessary and extra heavy covering paper

Complete Kit SF-35, as described above and including full size, completely detailed, copyrighted drawings (4 panels 17" x 44"), containing every bit of information necessary for building the model, shipped anywhere in the U. S. by express in a strong box 4 x 7¼ x 40", (contains a large quantity of special materials, dope, cements, etc.), shipping charges "collect" (wt. 9 lbs)—for only **$6.50**

(Drawings alone not sold. To foreign customers, SF-35 Kits 25% extra, but inquire of steamship companies rates of delivery to your city—we are not responsible for expenses of mis-shipping and must charge accordingly.)

Don't wait—every day counts—send your order today, and we'll rush the Kit to you at once. Hurry!

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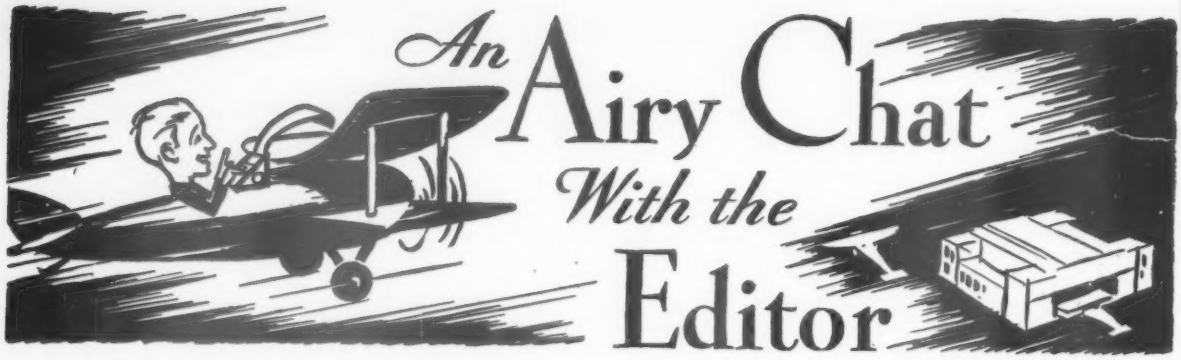

An Airy Chat With the Editor

I HAVE had experience with many magazines, but never yet have I seen the same friendly, loyal feeling extended to a publication that our readers have extended toward P. A. This is a warm personal regard that makes our large circle of readers seem like one big family.

Each reader seems to make it a personal duty to contribute to the welfare of POPULAR AVIATION in every conceivable way and to assist the editors by their various suggestions. Their bright and inspiring letters have converted a difficult editorial job into a most pleasurable occupation.

All of this helpful spirit and cooperation does much toward creating a bigger and better magazine. It has made it possible for this magazine to grow and prosper even in the face of the present financial conditions and our best wishes and thanks go to those who have been our firm friends.

* * *

WHEN WE look back into the history of aviation, we note a peculiar situation. That is, so very many of the outstanding developments and improvements in flight have been made by brothers. The balloon is due to the Montgolfier Brothers, the airplane to the Wright Brothers.

The Farman Brothers, Henri and Maurice, were prominent aviation pioneers in France. And their contemporaries, the Voisin Brothers were equally famous. Then we have the Short Brothers of England, The Roberts Brothers of America, together with the two noted Besler Brothers of this year who built the first practical steam driven airplane.

* * *

YOU FELLOWS should have seen the response to our inquiry in last month's Airy Chat, asking if you wished the full page picture feature retained. Ye gods and little fishes, what a deluge of mail came pouring into the office after that announcement! Well, you will have the picture once more, and we hope that you will like it.

* * *

THE AKRON DISASTER has been extensively discussed all over the world, both in the daily newspapers and aviation magazines, but there is still more to come on the subject. In this issue you will find an article by a prominent engineer who takes the matter up from another point of view and which you will find mighty interesting.

It is not only because we deplore the loss of the Akron that we give so much attention to the disaster, that is past and gone, but it is for the reason that a new fleet of dirigibles for commercial service is being contemplated, a project that will run up into a hundred million dollars or more. Read this authoritative article and see how you feel about the construction of more dirigibles to be built on a bigger and more extravagant scale than ever.

* * *

NOW, BUNCH, here is another contest for you with a prize attached to it. Just look over the picture of the Aeronca on the front page of the November issue of P. A. and tell us what is wrong with the drawing. There is an error that escaped the editors, the artist and all of the readers—except Chas. F. Johns of Sackville, N. B. The first ten readers who discover this perfectly obvious but very minor error, will be awarded one year's free subscription to POPULAR AVIATION.

* * *

EVERYBODY HAS the twin-motor, low-wing mania for transport planes. First came the Boeing "247," used on United Air Lines; then came the very recent Douglas "DC-1" that is to be used on the TWA, and finally we have the forthcoming Lockheed "Electra" which will be ready for test within a short time.

Fierce competition among the air lines is forcing the speed issue and the quietness factor. Just at the moment the Twin-motored low-wing is the ultimate in fashions, but how long this type will survive is difficult to say.

Attention

IN OUR next issue we will star our big new feature—the full page photograph that we have been discussing for so long a time.

This picture of a modern airplane is a worth-while addition to POPULAR AVIATION *for which so many of our readers have been clamoring. It carries no advertising and therefore is excellent for framing or wall decorations.*

ANOTHER STEAMER is on the way! Down in Ohio, two young men are putting the finishing touches on a steam driven monoplane that promises to be just as big a surprise as the notable experiment of the Besler Brothers, some months ago. Hope the Ohio boys will be awarded by success.

* * *

THE AIRLINER is becoming of economic importance. At the Aero club, the other night, there was an informal discussion on the various methods of public transport, the railroad, the bus line and the airplane.

One member pointed out that both the railroad and the bus line carried an overwhelming investment in matter of roadbed. The railroad right-of-way and its maintenance was a huge charge, but was taken care of out of the earnings of the road. In the case of the bus, however, we have even a greater road way expense, but one that is carried entirely by the tax-payer.

In other words, the bus-line is becoming an unsupportable burden on the tax-payer who is put to enormous expense in repairing the roads damaged by the heavy high-speed buses. The bus fare may seem cheap, but it is actually very expensive when the tax burden is added. The railroad fare, on the other hand, includes the investment and maintenance charges.

Therefore, in time to come, when suitable engines and fuels have reduced the cost of airplane operation, air travel will eventually be the cheapest of all since the fixed charges against the roadbed will be eliminated. This will relieve the burden on the tax-payer to a very great extent.

* * *

AS I WRITE, I have four very attractive copies of the Cleveland Modelmaking News lying before me. These are very excellent magazines published on the art of airplane model making and should be read by everyone interested in this subject.

Each issue contains a large sheet of plans showing a scale flying model, drawn to a scale of ¾ inch to the foot. Every detail is shown full size and the drawing is fully annoted so that the construction is greatly simplified. A very complete description of the model

(*Concluded on page* 404)

XUM

POPULAR AVIATION

Including SOUTHERN AVIATION and AERONAUTICS

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

Volume XIII | DECEMBER, 1933 | Number 6

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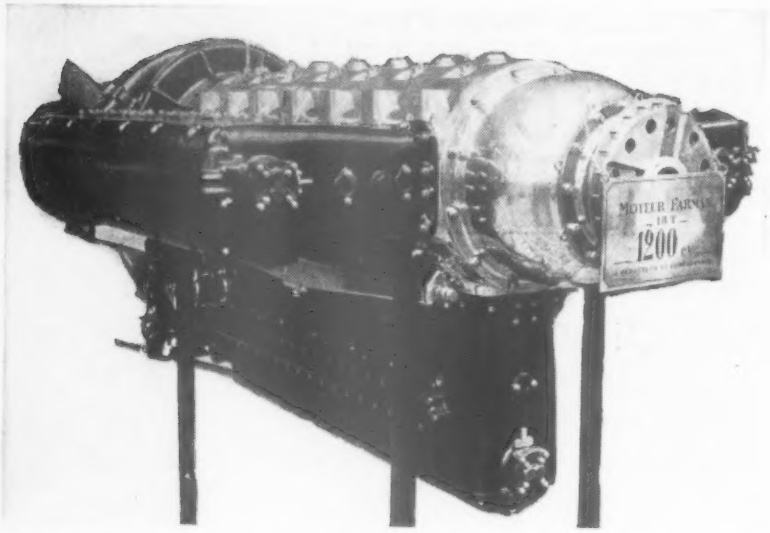
Aviation Engine Design — It



The 1,200 horsepower Farman Type 18T engine, a French design in which a special broad "W" arrangement of 18-cylinders is placed in an inverted position. There are three blocks of six cylinders per block, liquid cooled.

by

GLENN D. ANGLE

Nationally known authority on aviation engine design.

DISCUSSIONS of engine design trends, such as have appeared frequently in the technical press, or in the form of papers read before engineering societies, seldom fail as topics of current interest.

However, one noticeable peculiarity in most discussions of this character is the tendency to judge the trends solely upon what the manufacturers are developing or producing. Should one or more manufacturers be following a tangent, as they so often do, the statements might impart a distorted conception of the conditions as they actually exist.

It has also been observed, in many instances, that the party advancing his opinions has laid too much stress upon certain phases of these trends, because he has been unable to avoid the influence of the developments with which he was intimately associated. Of course, an error of this sort is only human and should not deserve severe criticism.

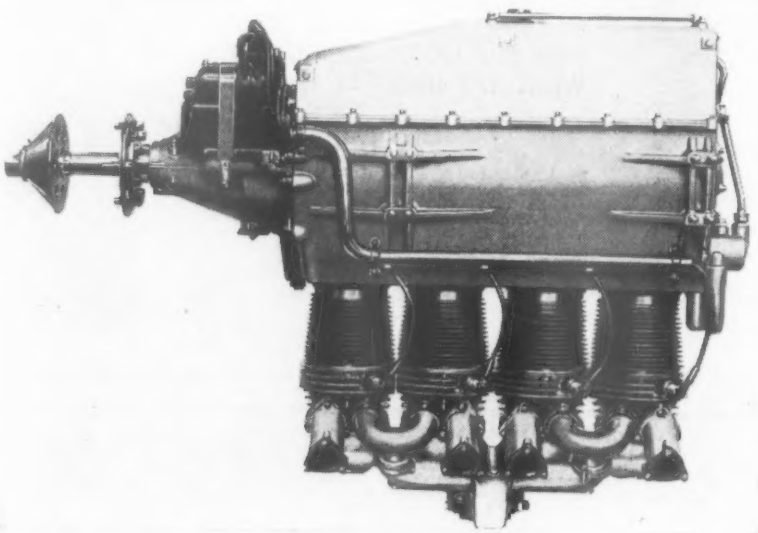
In the present discussion of the future design trends of aircraft engines, however, it is aimed to follow a slightly different course; that is, to base the remarks primarily upon existing design knowledge. While references to some of the present day developments cannot very well be omitted, it is not really intended that they should be pointed to as proof of the opinions advanced.

Before we get into the discussion with regard to these design trends, it might be well to consider a few important facts concerning aircraft engines and their development. Astounding as it may seem, it is nevertheless true that the records of the past thirty years show the names of nearly five hundred manufacturers or constructors who have engaged at one time or another in fabricating and developing aircraft engines in various parts of the world.

This figure does not include individuals or concerns building units or parts going into the construction of these engines, nor the Governments or military services of these Governments sponsoring the designs. Obviously it cannot take into account the many constructors whose only designs were prepared more or less privately, or those whose engines failed to operate sufficiently well to justify some mention in the trade papers.

The records show further that, since the advent of mechanical flight, over eighteen hundred different models of aircraft engines have been built. While it would be rather difficult to estimate the possible increase in this number if all models were on record, or to even guess how many designs were undertaken which never advanced beyond the drafting room stage, we must at least agree that the figures we have are much greater than one would ordinarily imagine.

Figures of this sort have little meaning in themselves, but they become rather impressive when viewed in the light of the actual number of units produced up to this time. Few industries would show comparable ratios, although they might not be so far out of line when regarded on the basis of valuation. The significance of these statistics lies not only in the fact that the building of engines for aircraft propulsion is seemingly possessed of attractions beyond profit, but it has undoubtedly endured a great many so-

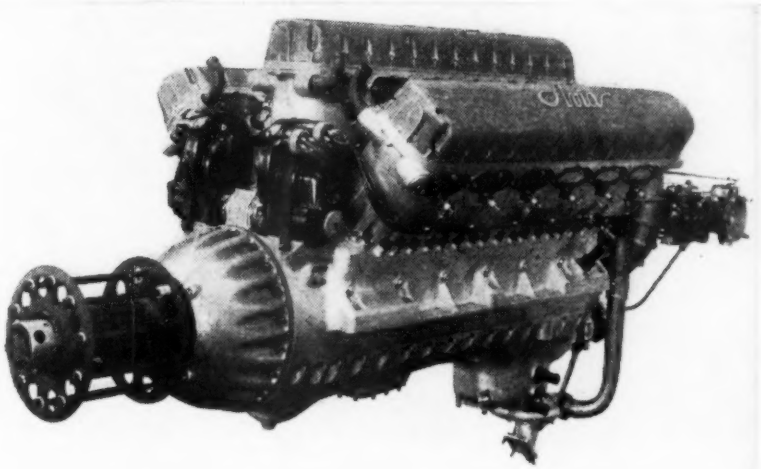


A typical 4-cylinder in-line air-cooled aero engine of the "inverted" type. This is the well known Argus engine prominent in Europe for sportplane service.

— Its Present Trend and Future

WE ARE happy to present this interesting and authentic article by Mr. Angle to our readers. The author was formerly connected with the U. S. Government as an aviation engine expert and is therefore in a position to be in touch with the latest developments in engine design.

A second article by Mr. Angle, will follow in an early issue of POPULAR AVIATION.



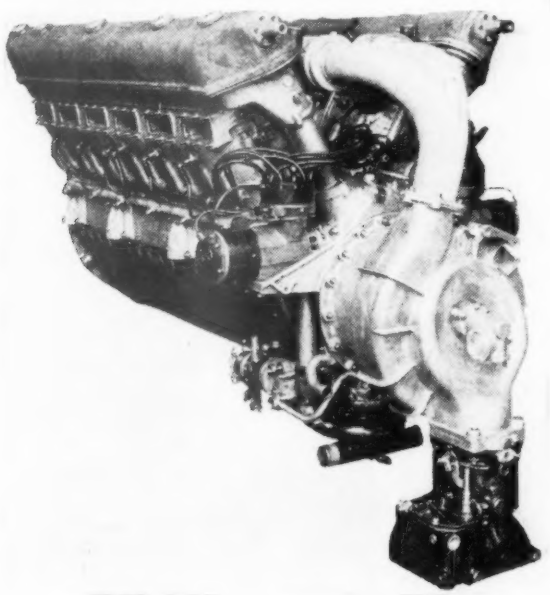
The Avia W-44 engine is a typical 18-cylinder "W" type that is built in Czechoslovakia. It develops 1,000 h.p. at 2,400 r.p.m. It is fitted for a supercharger and arranged for direct or geared propeller drive.

called trends during a period of intensive development.

The special characteristics essential to a satisfactory aircraft engine are so universally well known that we shall not dwell upon them here. It is desired, however, to call attention to the fact that the requirements peculiar to aircraft installation, together with the wide range of power outputs employed, have provided the designer with an extensive and rather unrestricted field in which to display his talents. It has resulted in a vast array of types, of which several have been decidedly freakish in character.

The history of aircraft engine developments has repeatedly shown one particular type ranking first in popularity for a time, only to be forced out of this position later by an entirely different type of engine. Moreover, few engines ever reach the final stages of development before so many refinements are deemed necessary that they are considered practically obsolete in design. Thus, there has been fairly rapid succession of changes and improvements, which usually followed such an orderly sequence that they can be regarded as a series of trends.

As we study future trends, after three years of depressed conditions in business, we should not be influenced by any activities of a promotional character. The organizations building engines for the military services and for the use on the regular commercial air-transport lines, seem to have continued their development work in an orderly fashion. But the companies providing smaller engines for sport and privately owned airplanes have been, for the most part, practically stopped in their tracks. The market for airplanes of this class, however, should return and grow rapidly just as soon as the buying power of the nation, as a whole, approaches normalcy.



This is the supercharged Lorraine "Petrel," a typical 12-cylinder "Vee" engine of French design. It is liquid-cooled and develops 675 h.p. at 2,200 r.p.m.

It is sincerely hoped this turn for the better will not occur so rapidly that the manufacturers will fail to devote the necessary time and energy to the further improvement of their products, because should we have unrefined engines marketed by quickly organized companies once again, this branch of the aviation industry will receive a serious set-back from which it will take some time to fully recover.

IN dealing with the different phases of design trends, we should consider first the most distinguishing characteristic between aircraft engines of all types; namely, the cycle of operations. Up to the present time, engineers have favored the four-cycle engine. Statistics show that approximately eighty-nine per cent of all models constructed have employed this principle of operation.

The two-cycle engine claims approximately six per cent of all models built, while less than two per cent is made up of engines operating on the Diesel cycle. The balance, or slightly over three per cent, are partly made up of six-stroke engines, but the majority would ordinarily be placed in the other groups if they were not so unconventional otherwise as to require a separate classification.

The features of the four-stroke cycle are sufficiently familiar to everyone and will not need any detailed explanation here. The writer feels, however, that if we can neglect for the moment all consideration of the features involved, and assume that as much effort had been devoted to the development of the other types, the above ratios would be considerably modified. Nevertheless, the four-cycle engine, due to its advanced stage of development, will continue in favor for several years to say the least.

It will probably be the result of an important discovery when some other

method of operation reaches greater heights of popularity, and in this connection, I am thinking too of steam power plants, which have been frequently proposed, but never developed to any extent until just recently.

The two-cycle engine has been built in various forms for aircraft, but the only application, in which there appears to be any immediate possibilities, is in the light airplane. The simplicity of construction assures low manufacturing costs, which are extremely important in engines of low output. In larger engines, this feature is secondary to other well-known characteristics.

During recent years, much effort and thought has been devoted to the use of non-inflammable fuels. Ample justification can not be found for this in the fact that the added possibilities of fire with gasoline aboard constitutes one of the greatest potential hazards existing at present in the operation of aircraft. However, the problem of developing the use of heavy fuels in an aircraft engine is by no means an extremely simple one. While several fuel-injection engines, including mostly the Diesel or compression-ignition type, have been built and tested in flight, the development has been mainly in the nature of research in which much valuable information has been acquired.

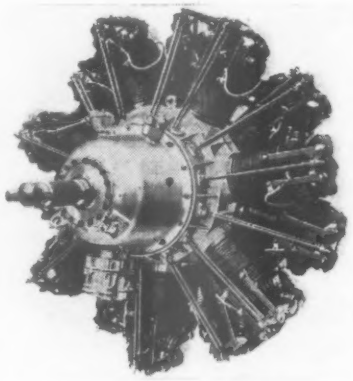
Even though the compression-ignition type of engine has so far received the most attention among those designed for use of heavy and non-inflammable fuels, it is believed that the claims for lower specific fuel consumptions, and the further reduction of fire hazard by the elimination of electrical ignition, are features which often have been over-emphasized.

Modern aircraft cannot well dispense with electrical apparatus because of radio equipment for avigation purposes and lights for night flying, not to mention electric starters for engines which have become quite universally used. When highly volatile gasoline is carried as fuel, this added fire hazard of electrical apparatus is not to be denied; however, it should not be a factor of any vital importance in connection with the use of less inflammable fuels.

The economy in engines of this class lies both in the cost and the amount of fuel consumed, but seldom does it ultimately result in economies as great as advocates of this principle of operation would have us believe. Compression-ignition engines often consume more than a normal amount of lubricating oil, therefore the quantity and cost of it should always be added to the fuels used in order to make accurate comparisons of this portion of the operating expenses.

Even if these corrected figures would still favor the compression-ignition engine, we haven't yet arrived at a true measure of economy. These engines invariably cost more to build, even with the elimination of expensive ignition equipment—at least they have up to now, and there appears to be no immediate hope of substantial reductions in this direction. There is also the question of weight, not to mention the various difficult engineering problems which must be overcome in these designs. All of these factors must be taken into account, because they reflect upon the true efficiency and economy of such engines in comparison with the more conventional types, and after all here lies the final answer to the question.

The above remarks are certainly not intended to throw an unfavorable light upon these developments, because the writer firmly believes such efforts are fully justified. It is merely hoped that by these statements, the situation will be clarified for anyone who has not taken the trouble to analyze it fully. We have all heard non-technical statements to the effect that before long all internal combustion engines will be operating on heavy fuel. Such opinions are without foundation, and we might rightfully go so far as to consider them ridiculous.



The Armstrong-Siddeley "Leopard," the largest air-cooled radial engine constructed in Great Britain. It is a 14-cylinder engine with a rating of 800 h.p. at 1,700 r.p.m.

While we may expect a gradual increase in the use of engines of this class as their development progresses, it is impossible to intelligently picture —from existing technical knowledge on the subject—a time when they will be used in larger proportions than engines operating on different principles.

The automobile took over many duties previously performed by the horse, but it certainly has not entirely replaced him. I heard a story just the other day that sounds so amazing it is hard to believe, but without checking its accuracy, I will pass it along for whatever it may be worth in illustrating the point which it is desired to convey. I was told there are more horses in this country today than ever before, and a horse-shoe salesman, when his friends began joking him about his antiquated business, came back with the statement that his company was now selling more horse-shoes than at any time in the history of their business.

Perhaps the most logical field for the compression-ignition type of engine is in lighter-than-air craft, where fuel economy and reduced fire hazards are matters of paramount importance, and where greater weight in the engine can be tolerated so long as it is balanced by reduced fuel consumptions during a long cruise. The field for units of this type will also be confined to the larger range of power outputs, as there are no obvious advantages in adopting this principle of operation for aircraft engines delivering less than three-hundred horsepower.

What I really expect to develop in the next few years is the greater use of fuel injection for engines of all types, but the majority will retain electric-spark ignition, and many of them will operate with normal compression ratios. There is nothing about an internal combustion engine which offers such a fertile field for improvement as the existing types of induction systems.

It is needless to point to the almost hopeless problem of delivering a fuel and air mixture of equal quantity and quality to each cylinder of an engine through the ordinary intake manifold. What may eventually develop is a device for mixing fuel and air right at each inlet port of the cylinder, with throttle control by a device which meters air and fuel in the proper quantity under all conditions.

SUPERCHARGERS

With induction systems fresh in our minds, let us see what the future may hold forth for the use of the supercharger. The rapid increase in adapting superchargers to aircraft engines during the past few years is sufficient evidence that they are serving their intended purposes. The primary reason for developing the supercharger, which began during the early part of the war, was to maintain engine power at high altitudes by supplying initial cylinder inlet pressures approximating ground level densities. As engines, superchargers and fuels improved in the regular course of refinement, it became the practice to provide pressures above atmospheric and thus effect an increase in normal output.

The advantages of the supercharger have been so clearly demonstrated that it is unlikely many engines delivering more than four-hundred horsepower will ever be designed without them. With the development of the built-in engine-driven supercharger, the early practice of regarding this unit as an auxiliary must now be completely discarded. Most manufacturers provide means for driving impellers at different speeds to accomodate the various requirements of the service, but this is simply a matter of interchanging gears, and it should in no way permit one to view the supercharger except as an integral part of an engine.

In some radial engines, a slow-speed rotor or mixing fan is employed with

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The High Flying Army Air Corps

by ERNEST McGAFFEY

High altitude flying practice is now absolutely essential because the present perfection of anti-aircraft guns have forced the airplanes away up in the thin air at from 25,000 to 30,000 feet.

MILITARY movements by warplanes such as are in use at March Field, Southern California, demand high altitude flying as an essential element for either offense or defense in aerial warfare. The main object of high altitude flying from a military viewpoint, is to gain advantage over an enemy. Anti-aircraft guns are not effective upon planes at heights over 25,000 feet. When the altitude of the planes is varied, the gunners on the ground are unable to time the shell bursts effectively.

A pilot having the upper ceiling of altitude is not menaced by a surprise attack from an enemy plane, and has a superior position from which to make a successful swoop on an adversary. Jockeying for "position" in a plane to plane fight is a life-and-death maneuver, and calls for every ounce of skill and daring a pilot possesses.

However, a good a shot he happens to be, he must be in a position to get in the first and deciding volley at his opponent's plane if he hopes to send it earthward with its occupant or occupants. And the higher over his foe he may be at the moment of sighting him, the better chance he has, all other things being equal, of coming out the victor.

It is a curious fact in natural history that when two eagles engage in a beak and claw fight, each bird seeks to soar above the other to gain a point from where he can carry on the battle more advantageously. The natural inclination in both bird and bird-man is to fight from above, not from below. And so it will be noted that in the thrilling dramas of aerial warfare of the great world war, the principle of high altitude flying was of prime strategical importance.

—Official Photo, 23rd Photo Section, U. S. Army Air Corps

Here are the U. S. Army Air Corps pursuit pilots all togged out for a day in the near-stratosphere. In front of them is the standard equipment for this work.

—Official Photo, U. S. Army Air Corps.
Lieutenants Morse and Anderson, March Field, with their oxygen supply for high altitude flying with the pursuit group.

Flying the planes at extremely high altitudes involves numerous difficulties; not the least of which is the very low temperatures encountered at any time of the year, particularly during the winter months. The extreme cold also has a detrimental effect on the engine. If a water cooling system is used, the water becomes much too cold and sometimes frozen. In unusually cold air, the hot exhaust gases from the engine condense and freeze, leaving a white smoky trail behind the plane. This is known as "frozen smoke."

The formation of ice on the wings of an airplane in the upper regions of ether, has been claimed to have been the cause for more than one disastrous accident. Such conditions are especially dangerous in unusually stormy weather, and particularly where a pilot is travelling over mountainous country, where a sudden descent might bring him into collision with some lofty peak, or the tree-tops of a mountainside.

When a pilot is flying at altitudes of 15,000 feet or greater, the use of oxygen equipment becomes advisable, and necessary at 20,000 feet. High altitude flights without oxygen causes the pilot to suffer physically. Respiration becomes much faster and shorter, and in addition sensations of vertigo and pains in the head become evident. With the aid of oxygen equipment, a pilot can remain at high altitudes for the duration of the oyxgen supply, which is determined by the mission to be performed.

Speed is of course a vital factor in aerial warfare. Recent changes and improvements have added enormously to the possible mileage per hour of military planes, and their efficiency in that respect has been correspondingly increased. What future developments will be along such lines, is hard to determine. The dazzling speed attained by motor-cars on racing tracks, and the newest types of exceptionally fast railway trains, indicate that there is no hard and fast line that can be drawn to set a limit to machine rapidity. In the airplane world, the advance from the flight speed of former days to wh

can now be accomplished, seems almost phenomenal.

Greater speed is attained at higher altitudes due to the super-charger, which gives the engine a performance equal to that at low altitudes, while the air resistance against the airplane decreases. At high altitudes a plane does not respond readily to the controls; and maneuverability is slightly impaired, but the propeller wash offsets much of this. Pursuit planes are not affected in this manner as much as are the larger and slower planes.

For attacking cities, forts, canals, airdromes, ammunition supply centers, etc., high altitude flying by the heavier bombing squadrons, attended or defended by a fleet of pursuit planes, offers a serious problem for the world to solve. While the dropping of a thousand or two thousand pound bomb cannot be expected to be controlled with the accuracy of artillery or rifle fire, it can cause havoc in the densely located area a metropolis presents, or the large target a fort or a supply depot offers. Absolute accuracy is not necessary.

The service ceiling of a plane is the highest altitude at which the plane and engine will function, handle and maneuver to the best advantage and meet in the most satisfactory manner the requirements for that particular type, without losing its efficiency. The difference in altitude between the service ceiling and the absolute ceiling depends upon the type of ship. By using every means and forcing the ship as high as it will go, the absolute ceiling of that type of ship is reached.

The weight and type of flying clothing worn by aviators when flying at high altitudes depends upon the climate and weather conditions, and upon the expected duration of the flight. Leather sheepskin lined flying suits are worn for protection from the intense cold and sometimes electrically heated suits are necessary. Leather face masks lined with chamois skin in combination with the helmet make up a part of this equipment. The mask has an opening for the nose and mouth which is essential to the use of oxygen equipment. Heavy sheeplined pig skin shoes and fur-lined leather mittens complete the aviator's clothing. High altitude clothing and parachute weigh nearly fifty pounds.

This specially heavy clothing used in high altitude flying is as essentially necessary as any part of the plane itself, or the fighting equipment. It is self-evident that the pilot must be thoroughly protected in such rarified atmosphere. The drop in temperature experienced, as the planes rise to heights of the most icy and bitter cold, cannot be realized except when actually contended with.

It seems significant that the unusual

(*Concluded on page* 408)

Byrd About to Make Second Antarctic Trip

This is the Curtiss-Wright "Condor" that will be used by Byrd in surveying *Little America* near the South Pole. It is powered by two 575 h.p. Wright Cyclone engines.

ADMIRAL BYRD and 70 of his men are about to set sail for another great adventure in the vast, unfriendly South Polar regions.

Monoplane, biplane, autogiro, snowmobile, tractors, steamship, auxiliary sailing vessel, outboard motor boats—all these are necessary to the Byrd Antarctic Expedition II in the accomplishment of its scientific objectives.

Little America is more than 10,000 miles from New York and it is there that the most completely equipped polar expedition ever organized will base. To cover this 10,000 miles, Admiral Byrd has selected two ships, the "Jacob Ruppert" and the "Bear of Oakland." The "Bear" is an ice-breaking sailing vessel of glorious history with the Coast Guard in Alaska having auxiliary power and the "Jacob Ruppert" is a fuel-oil-burning ex-Shipping Board vessel in the 10,000 ton class.

These two vessels carry in their deep holds and on their decks, a complete and variegated automotive equipment and a huge and just as varied supply of Tidol fuels and lubricants for its operation. Almost every type of automotive engine now in use is represented—air-cooled radial engines for the airplanes, water-cooled truck engines for the snowmobiles, outboard motor boat engines, engines for self-contained generator units and a Diesel engine for a high output of electrical current and the steam engines of the vessels.

Some of these units will run the entire gamut of climatic temperature and service operating conditions. During the Expedition many of these power plants will be subjected to temperatures of from 100 degrees Fahrenheit on the Equator to 70 or 75 degrees below Zero in the Antarctic.

Included in the automotive equipment of the Byrd Expedition are a Curtiss Wright Condor airplane with two Wright Cyclone engines of 575 h.p. each; a single motored Fokker plane of 575 h.p.; a Pep-Boys Snowman Autogiro with a 220 h.p. Kinner engine.

Already at Little America, probably buried under many feet of snow and probably in as good condition as when they were left in January, 1931, are one tri-motored Ford plane and one single motored Fairchild plane—a total of five planes each designed and equipped for a special purpose.

When equipped with aerial photographic material, it will be possible to map out these desolate regions thoroughly—something that has not been accomplished hitherto by explorers in this part of the world. Further equipment will permit of magnetic explorations, thus possibly gaining data on magnetic deviations.

Admiral Byrd (left) is discussing matters in regard to the fuel supply with an oil official.

Can the Airship be Made Safe?

by I. OESTERBLOM, M. Am. Soc. C. E.

The author, an internationally acknowledged expert in the estimation of indeterminate stresses, discusses the probable reasons for the many airship disasters with a view of making the airship safer.

AFTER all airship disasters, there have followed acrimonious discussions between designers, builders, and navigators to determine which one of the three have been at fault. It is never assumed that all might be guilty.

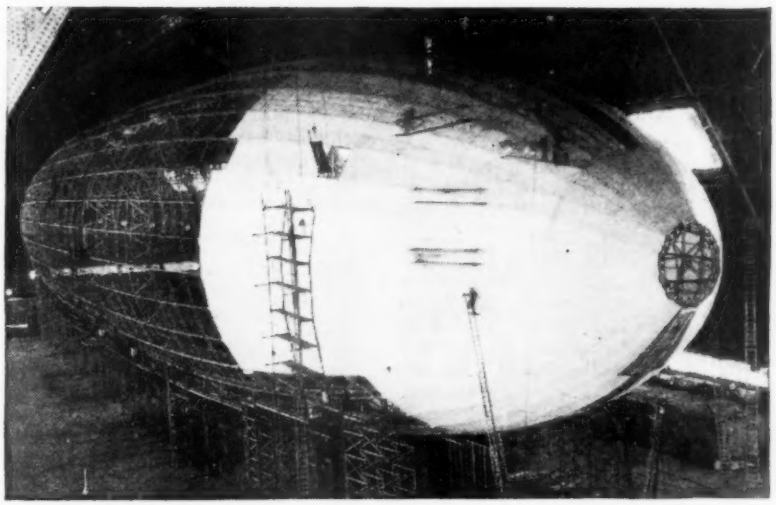
The gentle public, is paying for the ships, and, if they are successful enough to go into commercial service, they also have the alluring chance to go down in a wreck.

An airplane may shoot straight up in the air if it has accumulated sufficient inertia to defy gravity, it may fall nose first, or it may even travel upside down —but in all positions it has sufficient strength to carry its loads without failure. It is so provided in official regulations regarding airworthiness.

Has similar airworthiness been provided in the airships, and if not, do the navigators know how far they may go in the matter of airship acrobatics?

The comparison and the question are very proper and pertinent, and yet we must smile at the seemingly ridiculous, when we remember that the transverse frames in the process of erection have sometimes collapsed under their own weight. We also remember how the unlucky Shenandoah, in its endeavor to show off at the Ohio State Fair, had to buck ugly weather and was shot skywards towards its destruction, and how reversely several other airships had to nosedive. One of them into a hillside of Northern France and the second into the Atlantic Ocean.

Only the R-101 in these affairs came out with fair honor. She was cracked and her nose crumbled, but the rear half of her frame was lying there intact, a silent monument to her able designer, who lay dead in the wreck.



The giant frame of the Akron partly covered with its external fabric sheath. Note that this covering is independent of the gas-bags.

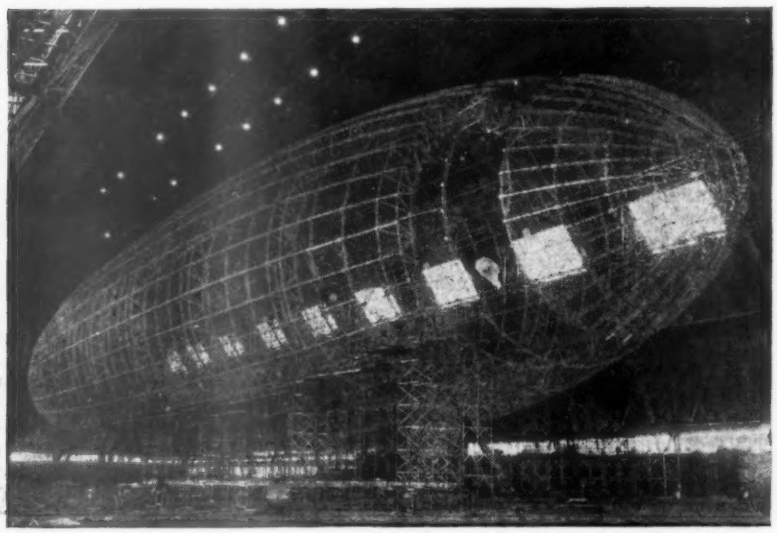
The Shenandoah, a copy from German designs, and the Akron, built on German patents, were most completely wrecked. The forepart of the Shenandoah tore away to a successful venture of free ballooning. The middle part was severely deflated and crashed violently. The aft section came down slowly, tail first. There is less clear testimony in regard to the Akron. Evidently she pitched down heavily until she struck water, where she was completely destroyed.

It is in order to stress the foreign influence on these ships, and this for the sake of contrast, because by proportion the foreign built and foreign navigated ships have had very few accidents. From this, one might be inclined to say that the failures must be charged to incompetent airmanship and error in navigation.

It would seem so with the British R-101, which was most carefully and brilliantly designed and even so went to its destruction. It is hardly a defense to say that the night was terrible, for the night might have been avoided if weather reports had been studied more closely.

It is admittedly neither difficult nor dangerous to sail an airship in a steady wind, and even a very severe one, no matter what the direction of the wind and the ship. The drift will always have to be allowed for, and to go dead against a heavy wind means a great deal of extra fuel—a matter chiefly of foresight and management. The bending moments caused by steering with a heavy yaw are fairly provided for, and this must be admitted even in spite of prevailing empiricism in design, for traffic in storm has never in itself lead to disaster.

The factor of safety may be low, but at least it has been sufficient for normal traffic through storms. It is not the storm, but the wind squall, which de-



The structural elements of the "Akron" exposed.

stroys the airship, and the squall is erratic both in regard to direction and behavior.

The squall shoots through the air like an airblast out of a pneumatic nozzle—limited in diameter, but of great velocity. A few years ago, no provisions were made against them in design—one simply did not go up in squally weather or into squally territory. Later on, one provided for a squall velocity of 1,500 feet per minute, later yet for 4,000 feet. One has actually never measured as high as this —but how many severe squalls have been actually recorded? It should also be remembered that in both hydro- and aero-dynamics the highest record is always a suspect(because one blast may come soon that will beat them all most severely.

Squalls generally play in hilly country, induced by heat and pressure conditions up and down the hillsides—sometimes cross-country. They may also collide and combine and therefore occur at unexpected places. Captain E. A. Lehman, an experienced navigator, claims that the squalls can be seen and felt far away and may therefore be avoided.

Perhaps Capt. H. C. Irwin of the R-101 would not have agreed to this—or he might not have had sufficient experience to see and feel the squall which brought his ship to earth. And the night was dark and terrible, the worst ever seen by the London-Paris pilots.

The squall which shot the Shenandoah up into the skies must have been terrific. Pictures made from the description of eyewitnesses show a pitch of well over 50 degrees. The ship in this blast was clearly quite helpless and no operation of the elevators would have been of any use. How was the design of the ship for this peculiar position? Was there strength enough to carry the loads at this angle?

Perhaps, Commander Lansdown knew there was not and therefore frantically tried to reverse the position. He succeeded only too well, not to buck the squall, but to get out of it. Inescapably the squall caught the departing tail with the elevators erroneously set for down flight, tipped the ship tail up and nose down and broke the hull into three parts. It is not sure that all happened just so, because the evidence is contradictory, but this seems the reasonable substance of the testimony.

That only eight gas valves were available to release the pressure in eighteen bags for this rapid ascent may have been the cause of exploded gas bags and broken some of the framework simultaneously, but this will detract nothing from the general description. It is well to remember the gas valves, however; they added to the difficulties and to the fear of handling in a dangerous position.

An expert airship consultant, was right in saying that there should have been one valve for every bag—and he said so before the disaster. The recording barometer had stopped at 7,000 feet —little chance to release the bags sufficiently for the violent, almost instantaneous travel from the previous level of 1,500 feet.

The Akron disaster was due to a down squall, as was that of the R-101. Both of them were travelling at normal altitudes—1,500 to 1,600 feet, the R-101 with nimbus clouds below, and very slowly. She had covered 36 miles only in the last 2 hours and 10 minutes of her life. Both commanders tried to get out of the squalls and to rise to higher altitudes, but all in vain for such a short distance and with such violent blasts. Captain Irwin tried to rise through the aerodynamic effect of

Note the complex struts and beams employed in the construction of the "Akron."

speed, but even this in vain. So down came both ships, one to put her nose in to earth and the other into the water of the ocean.

We have thus a picture of airship wrecks from which to judge airmanship in its relation to design limitations.

* * *

In early airship navigation, one was satisfied with very modest speeds—30 miles per hour, and even less. Slowly, one increased to 60 miles, more recently to 80 miles, and even more. Setting the rudder against the wind, or the elevator for a climb, means bending in the hull, and more severely so for the higher speeds. The same is true for turning quickly. The mooring at a mast offers special problems.

All these matters are provided for also the special problems of bending due to squalls—in the strength of the hull and its frame. In England there has been a panel of experts sitting in judgment on the airworthiness requirements of airships, which have been officially published in the U. S. Very severe demands have been proclaimed for airplanes, but for ships there seem to have been none or none made public, presumably because the relations have been so intimate between the single manufacturer here and the Navy Department that none have seemed necessary.

We may take it for granted, therefore, that load distribution and gaslift are assumed fairly evenly balanced—as has been stated privately by officials—and that the suspension does not presuppose any great angles of pitch. Also that bending due to normal maneuvering and squalls are taken into account, but no more.

This is then the structural basis that the navigator will have to work with. He should also know that the rules of design for strength are only semi-rational and may be greatly in error as regards the strength of the transverse frames, and that this point is still to be settled by flight observations, pending which it behoves him to be cautious.

The conditions clearly do not impose a deadening inactivity but most assuredly a sense of airmanship. No sailing craft would set sail into the China sea on the report of a coming typhoon; neither should an airship go into a storm over a broken country or over the sea alongside a rocky coast. As a sea captain watches for threatening signs, so should an airship commander watch for the cumulus clouds, for they carry most of the treacherous and destructive squalls. Proximity to hillsides should also be avoided.

The designers may say that the ship is good for a 4,000 feet squall, and they may be right. However, the squall may be more than that, and—more or less—it is too much even in spite of all possible strength. It is a matter of space available: distance to the ground, to the nearest hillside, to the surface of the water. One must have space and time to maneuver slowly out of the squall, because there is in fact no other escape. One must help the squall to edge the ship beyond its border and have ample room to do this.

Inactivity is, in fact, better than nervous action, but cooly taking advantage of the relative position in the squall to get out is the real test of airmanship. If Fate be kind, one may have time to get out before it is too late, before there is a crash into solid substance.

The evil fate of the Shenandoah was special but not unusual. With the commander ready to take to the normal wind outside the squall, the least damage would have happened, but it all depended upon how airworthy the designers had left her, how the loads were suspended for the condition of severe pitch. Perhaps the suspension was such as to break the frame even before the turn at the final height came.

Is there a real chance, then, to keep

(*Concluded on page* 408)

Winslow's Hat Was In the Ring

by CARL B. OGILVIE

Captain "Eddie" Rickenbacker supplies the author with first hand information regarding Alan Winslow, the boy hero of the A. E. F.'s 94th Aero Squadron who was the first U. S. pilot to bring down a German plane.

"WHEN I first knew him, he was a handsome round-faced lad of twenty-one who made friends easily with his warm cheerful smile. When I saw him a year later he was an old man."

Thus spoke America's Ace of Aces in the World War, Captain "Eddie" Rickenbacker, of Alan Winslow, the youngster of the A. E. F.'s 94th Aero Squadron, the first U. S. Army pilot to bring down a German plane for the first American squadron at the Front.

When I learned that Alan Winslow, who had suffered from vertigo since his second paralytic stroke, had died of injuries suffered when he fell from a third story window of an Ottawa hotel, I called on Captain Rickenbacker in his offices of North American Aviation, Inc., for this exclusive story.

"When we got to the front," Captain Rickenbacker recollected, as impersonally as a war veteran yet as proudly as an officer speaking of a valiant subordinate, "Alan Winslow was the handsomest kid I ever saw. A strapping six foot lad, built to weigh one hundred and eighty pounds. He had a bright, rosy complexion and fastidiously shaved twice a day—except when he was at the front. But three months of war changed Winslow. Chateau-Thierry was the beginning of the end for him."

The great ace, who is now vice-president of North America Aviation, Inc., sat at his desk and gazed soberly towards the open sky above the Hudson River. He was in a reflective mood and I sensed he was not seeing the New York sky, but the battle-torn skies of France back in 1918. All that was necessary to get America's ace, who never permitted an enemy pilot to maneuver into position to wound him, to recount a vivid eye-witness story of Alan Winslow's brilliant achievement was my remark: "Alan Winslow won world-wide fame by shooting down the first enemy plane."

"Yes," and Rickenbacker's eyes, saddened by the news of Winslow's passing, brightened. "Fifteen years ago, It seems as if I were back at the Toul 'drome and it had just happened. On the evening of April 13, 1918, we were an exceptionally happy lot of pilots. You see, we had waited weeks for that day. At last we had reached the front. The next morning we would be in action.

We were grouped around our new Operations Board reading the first war order ever given by an all-American Squadron Commander to all-American pilots. It stated in simple terms that Captain Peterson, Lieutenant Reed Chambers and myself would start on a patrol of the lines the following morning at six.

Altitude was specified at sixteen thousand feet; our patrol was to extend from Pont-a-Mousson on the Moselle to St. Mihiel to the west of the River Meuse. Captain Peterson was designated flight leader and our patrol was for two hours until eight o'clock.

Here is the handsome boyish Alan Winslow whose daring exploits are set forth in this story of the American Air Forces.

"Lieutenants Alan Winslow and Douglas Campbell were directed in the same order to stand on the 'alert' at the hangar from six o'clock until ten the same morning. This 'alert' was provided for any sudden emergency; such as an enemy bombing raid in our direction, or a sudden call for help against an enemy plane within our lines. If Winslow held any secret disappointment for not being assigned to the first flight instead of 'alert' duty he said nothing. He was a good sport."

RICKENBACKER smiled. "And when that sudden call did come it was the case of the last becoming first. Winslow's plane was the last to take off. Yet he won the first victory and like the Jack and Jill nursery rhyme Douglas's victim came tumbling after him. The battle lines ran straight between Pont-a-Mousson and St. Mihiel and were about eighteen miles directly north of our drome, which was two miles east of Toul. Yet Winslow only had to zoom up five hundred feet above our drome and shoot down his adversary, who by the way, was a more experienced flyer than Alan. That made his victory all the more unusual.

"To get the correct picture of the situation, which will explain the presence of the two German planes over our drome on the morning of the 14th, it is important to mention that Toul is eighteen miles directly south of Pont-a-Mousson, while Metz, where the Hun squadrons were located, is twenty miles directly north of Mousson. In the heavy fog of that morning the two German pilots mistook our drome to be that of their own. They thought they were twenty miles north of Pont-a-Mousson when they were, in fact, eighteen miles south. An error of thirty-eight miles. But in warfare in the air a pilot only makes *one* mistake.

"The morning of the 14th was decidedly 'No flying weather.' Most of the French *escadree* remained grounded. But we were so anxious to take part in the

first patrol that Chambers and I took off and reconnoitered at fifteen hundred feet and blissfully climbed to the sixteen thousand feet to wait for Peterson. He followed up and immediately glided back to the field."

Half apologetically Rickenbacker explained: "I was still a novice. I didn't know then what even our youngsters in America know today about the dangers of flying in a thick fog—that we were taking our lives in our own hands. In fact Peterson believed we would follow him down.

"Chambers and I made four tours of the battle lines on that patrol. Turning back I was horrified to discover the whole landscape was lost in the dense fog. We couldn't see a foot ahead of us, to say nothing of our aerodrome. We were lost! Two German pilots happened to be in the same fix. They knew we were up and they were as lost as we were. There was nothing to do but dive through the blinding fog. I put the nose of my ship down and went through a hole, losing Chambers completely. I discovered I was over Commercy, ten miles from the drome. I flew by compass back home.

"Peterson gave me Hades when I landed for being a bloody fool for flying in the heavy fog. I realized then he was right and admitted it. When I was told that nothing had been heard from Chambers my previous fears returned.

"With a heavy heart I got out of my flying clothes and walked over to Headquarters to make out my report. I was positive the telephone would ring soon to inform us that Chambers had crashed and been killed in the fog. I would never have been able to forgive myself had that happened. Luckily he got back safely. When the phone rang I quivered in my shoes, while the Operations Officer answered the call. Then he shouted:

"'Quick Rick! Two Boche planes are reported over Foug. Send in an' alerte!'" Foug was on a line west of Toul. As the Germans were flying east they would shortly be over 94's aerodrome.

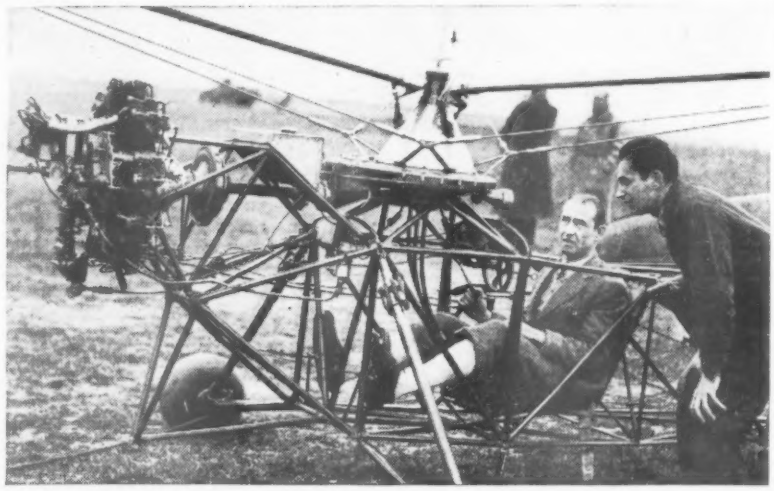
"Bolting out of the door of Headquarters I heard the roar of Rhone rotary engines. Campbell and Winslow, in Nieuports, were already climbing up into that deadly fog. They had been playing cards while standing by on alert. Now their only interest was to defend our drome from those two enemy planes.

"MY HEART chilled," admitted Rickenbacker. "Two youngsters going up in that blinding fog to battle enemy pilots. If they crashed into one another the war would be over for them before they hardly got off the ground!

"Pilots and mechanics boiled out onto the field to watch the 'Hat-in-the-Ring' Squadron's two second lieutenants evaporate into the greasy mist. They flew on the wings of Fate into blind adven-

(*Concluded on page* 412)

Austrian Inventors Claim Success With Helix



Showing the engine, fuselage, and turntable of the Hagler-Hofner helicopter for which success is claimed.

AFTER seven years of experimenting, Bruno Hagler and Raoul Hafner, two Austrian inventors, have succeeded in getting practical working results from their helicopter.

It is claimed by witnesses that this machine can take off and descend vertically as well as hover indefinitely over a fixed point. It can also be reversed, flying backward as well as forward, according to information received from Austria.

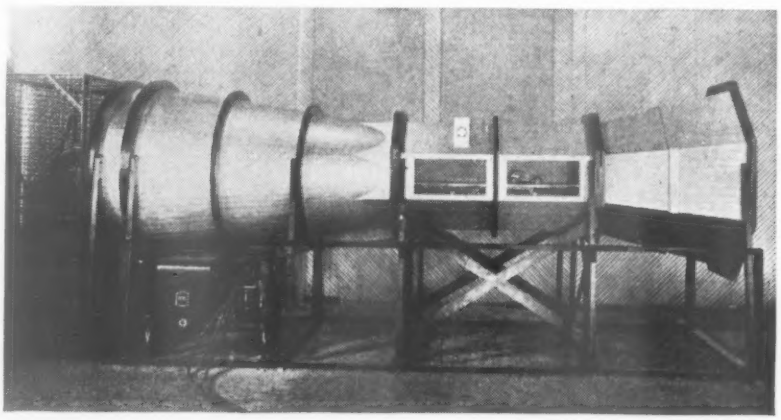
All operations of lifting and propulsion are performed by the rotor and no propeller is employed as in the Autogiro or the majority of helicopters. The engine drives the rotor through a bevel gear and clutch directly under all flying conditions, but it is difficult to understand just how the inventors have overcome the effects of motor torque.

The rotor blades are the ordinary Autogiro type but small wings, not unlike fish fins, are attached to each blade and it is in these fins that the helicopter differs from those previously constructed. The fins are the equivalent of the flexible autogiro blades.

Small Wind-Tunnel on Exhibition

A VERY neatly designed wind-tunnel of small dimensions has been on exhibition all summer at the Century of Progress, Chicago. It was designed and built by the U. S. Bureau of Standards, largely with a view of educating the public to the effects of wind resistance on automobiles, railroad trains and other vehicles.

This tunnel is so compact and simple that it should be of interest to home experimenters or small shops where aerodynamic properties of various bodies are studied. The model automobiles, which are shown under test in the tunnel, can be viewed through the glass sides, and this is a fine arrangement for viewing the air distribution by means of smoke filaments introduced at the suction end of the tunnel.



This small wind-tunnel will awaken the interest of the home experimenter in aerodynamics.

The Air Race Controversy

by FRED WALLACE

And here, we publish our readers' opinions on the advisability or inadvisability of holding air races. As the opinions are divided, about 50-50 it is up to the reader to make the final decision — thumbs up or thumbs down.

E. STANTON BROWN started something in the July issue of POPULAR AVIATION when he contributed the story, "The Air Race Racket."

Now, as all of our readers probably know, we thrive, prosper and delight in controversies and arguments, hence this story was a real pleasure because of the many comments, caustic and otherwise, that poured into P. A.'s offices. We delayed publishing these letters because we wished to get all of the final dope on the 1933 race meets and make a general check-up among the crowds that attend these meetings.

As might be easily understood, a flock of race pilots entered their enthusiastic and often profane comments on the article, which were not at all favorable to the opinions of the author and which, by the way, are also the fixed and fast opinions of P. A.'s staff. Some of the race supporters waxed exceeding wroth and stormed and ranted about in the expression of their displeasure. But, on the other hand, we received quite a number of favorable comments and recommendations from those of our readers who believe that the interests of aviation are not best served by a public exhibition of suicide and wreckage.

Our original contention, voiced over a period of years in the columns of POPULAR AVIATION, is to the effect that air-races are retarding the commercial development of aviation. We have voiced the opinion that the tales of disaster and sudden death carried after the air-races by the newspapers most certainly do not create a desire for the ownership of a plane, and it is the sale of planes to individuals that will really put aviation on its feet —financially speaking.

From its earliest infancy, aviation has unfortunately been in the hands of showmen and air race promoters or else in the control of military authorities whose requirements are diametrically opposite to the requirements of the private owner. Through the ballyhoo of the race promoters, a false impression regarding aviation has been created in the minds of the general public. Hence John Public, and his wife, Sarah Public, just can't visualize the airplane as an everyday serviceable vehicle for their own private use.

Strange to say, the aeronautic industry has not taken a page out of the history of the automobile manufacturers who were also blockaded for years by an epidemic of automobile racing and stunting. The automobile only became the serviceable vehicle of today through divorcing it from the race-tracks and promoting it as a logical substitute for the then horse-and-buggy.

Race track development, just as racing airplane development, demanded bigger and bigger engines, more power, less weight and other departures from the conditions demanded for practical service. Finally we arrived at the year 1906 when the whole automobile industry fell by its own weight and extravagance. It seemed as though the automobile was doomed to extinction in this year because race track logic and race track practice dictated a policy calling for a minimum price of about $2,500 for an automobile.

And then, in 1907, appeared the Ford Model "R," priced at $750. Nothing of race track practice was used in this Ford car. It was a radical departure from the super-cars on the market at that time, but it opened the way to volume sales that have since crowded the streets with reasonably priced cars. And yet the race-track promotors will tell you that the automobile is the outcome and the product of the race tracks.

Then came the airplane on which the racing men continued to load larger and larger engines until at present the racing plane is not much more than an engine provided with wings—absolutely ridiculous from any utilitarian point of view and a menace to all who use it. It is very doubtful whether the department of Commerce would confer an "NC" license on any special racing plane yet built in view of its low safety factors, abnormally high landing speeds or its control features.

In short, the trend of racing planes is exactly in the opposite direction from that necessary for a practical plane. Continually loading on more and more power gets us nowhere so far as volume production goes. Loading the wings to 45 pounds per square foot or the engine to 2.5 pounds per horsepower certainly would not be included in the specifications of a private plane for John Public and his family.

"Air racing serves no useful purpose," is a slogan that should be heeded

by all who have the welfare of the industry at heart. Even though a low priced plane could be built for a top speed of 200 m.p.h., it would not be safe in the hands of the average citizen. This is not alone from a structural standpoint but for the reason that 200 m.p.h. is objectionable from a physiological standpoint, regardless of whether this speed is attained in an automobile, airplane, wheelbarrow or baby buggy. The nervous reflexes, coordination and visual lag of the average person prohibit such speeds, and unless the human body is reconstructed to meet the new demands upon it, further increases in speed are useless.

And now we will make a survey into the reason how the airplane got that way. To this end, POPULAR AVIATION'S Inquiring Reporter made a canvass of the International Air Races held in Chicago, September 1, 2, 3, and 4, 1933. In addition to the inquiries made at the Curtiss-Reynolds Airport, many persons were interviewed before the races and also on the long trek to the races, before they were influenced by the spectacle of the races.

WHY I WENT TO THE AIR RACES

Question	*At the Airport*	*Outside Inquiries*
Hope that someone will be killed	14	21
To see crash (no injuries)	37	21
Hope to see pilot bail-out	11	8
Plane catch on fire	2	17
Pilot thrown out of ship	0	0
Accident total	64	67
Get thrill out of speed	4	15
Just for a day's outing	4	6
Enjoy contests and athletics	2	2
Interested in airplanes	12	11
Total reasons	86	101

And now doesn't this score amaze you? Many thousands of supposedly intelligent and civilized persons went to the races solely with a gladitorial spirit in the hope that some pilot would meet with disaster and possibly death!

And now, as an auxiliary to the above survey, the Inquiring Reporter interviewed these people on the subject of ownership, that is, whether the races had inspired them with the idea of ownership. Here we are.

WHAT ABOUT PRIVATE OWNERSHIP?

Question	*At the Airport*	*Outside Inquiries*
I would like to own a plane	18	72
Not for me—keep your million dollars	58	7
Not certain	10	22
Total	86	101

(*Concluded on page* 410)

The Aero-Sportswomen

by JOAN THOMAS

Members of the "99" club lined up before the start of the women's events at the races.

THE National Sportsmen Pilots championship contest, staged during the Charity Air Pageant at Roosevelt Field on October 7th and 8th, gave the amateur flyers an opportunity to take a leading part in the competition at a major air show.

At the National Air Races, the American and the International shows, the amateur flyer has little or no opportunity to break into the game where the professional pilot in high-speed, super-charged machines bar such competition. No doubt, these are good shows from the customer's point of view, but we feel that an amateur contest such as was put on at the Charity Air Pageant, and the unique aerial treasure hunt sponsored by the *Liberty Magazine*, will do far more to stimulate flying than half-dozen professional exhibits. It brings it down-to-earth—and Mr. Average Citizen suddenly realizes that flying isn't a miracle, nor are aviators a race apart. "Why," thinks he, "if these pilots are doctors, lawyers, stenographers and housewives, I wonder if I couldn't do it too?"

There were two divisions in the contest for Sportsmen pilots, one for men and one for women, apparently—to give the girls a chance! But the *Aero-Sportswomen* is proud to record that not only did the women pilots make a splendid showing, but that the two leading contestants in the final competition had outclassed all of the men.

Mrs. Cecil W. Kenyon of Boston, won first place in the women's division. With 1,017 points, she took the trophy and a purse of $5,000 donated by Dr. Eleanor Campbell of the Judson Health Center. Miss Suzanne Humphries of Far Hills, N. J., won second place with 999 points to her credit. And although she has had a total of only fifty hours of flying, she also defeated all of the men and nine other women flyers in the contest, which was judged on general excellence of flying and acrobatics. The two leading scores in the men's division were 977 and 929 points.

The Kate Smith Trophy race for women flyers was won by Edna Marvel Garner. The radio singer was present and presented the trophy. Francis Harrel Marsalis, Helen McCloskey and Peggy Remey finished the race in second, third and fourth places, respectively.

* * *

The Liberty Aerial Treasure Hunt which was conducted in connection with the Charity Air Pageant was indeed a unique air cruise for amateur flyers. Since all expenses for gas, oil, hanger facilities and hotel accommodations were provided for, it gave an opportunity for many private flyers to compete who otherwise would not have entered the cruise.

There were 81 ships on the line for the start in St. Louis on October 3rd. Capt. Frank Hawks acted as the "master of the hounds," remaining on the ground until all of the contestants had taken off, then in his famous speed ship he would be at the next point before the first arrived. At each control point the pilots were given a cryptograph, which when deciphered, gave the direction and number of miles to fly to find the next clue. The letters of the word LIBERTY, made out of white cloth and displayed in open fields were the clues, and observers stationed at each letter checked the planes in the order in which they flew over.

There were 41 planes who finished the entire race, arriving in New York

(*Concluded on page* 406)

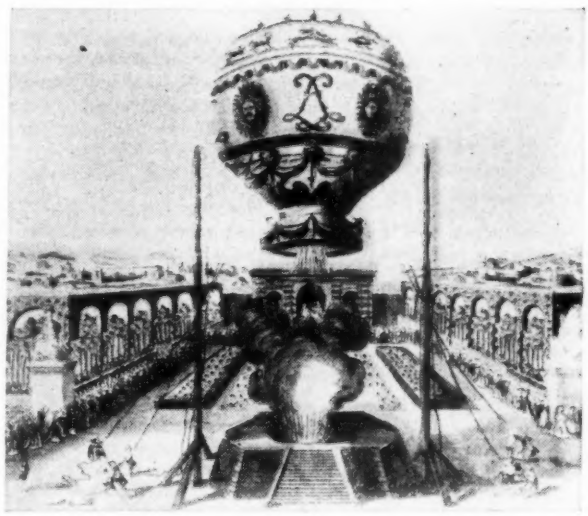
The Balloon is 150 Years Old

by GEORGE F. PAUL

The year 1933 is the 150th anniversary of the Montgolfier Brothers' first demonstration of the hot-air balloon — the pioneer of all flight apparatus.

ON June 5, 1783, Joseph and Steven Montgolfier gave the first public demonstration of balloon flight before a large and enthusiastic audience. They were not the first men to conceive the idea of aerial buoyancy, by any means, but they were the first to carry out the idea to a practical conclusion.

For several years before their public demonstration, the Montgolfiers had been experimenting with various substances that they knew were lighter than air. They first employed steam, but it condensed so rapidly that this agent was eliminated. Coal smoke gave little lift and was abandoned. Hydrogen gas also proved a failure with their crude balloons for it leaked almost as rapidly through the pores of the bag as they could fill it. Disheartened, but not to the point of stopping their experiments, they finally fell upon the idea that later proved to be a great success—filling the balloon with hot air.



The highly decorated Montgolfier hot-air balloon and its furnace, pictured in the gardens of M. Reveillin the paper manufacturer who helped defray the experimental costs of the balloon. This sketch was made in 1783.

An opening at the bottom of the balloon was placed over a furnace until it was filled with hot air, and it then was liberated for its upward voyage. Several balloons were burned before any success was had but in 1782 they finally achieved their objective with small balloons and then proceeded to make a balloon which, by their calculations, was powerful enough to lift themselves and several passengers. This balloon was more than 35 feet in diameter, weighed 300 pounds and had a capacity of 22,000 cubic feet.

Then, on June 5, 1783, they gave a public exhibition of the new device at Annonay, 36 miles from Paris, before an enormous crowd. It was placed over the furnace until it swelled out into its full spherical form, and at a given signal, it was cut loose and ascended to a height of 6,000 feet. During this time it drifted 7,668 feet in a horizontal direction and then dropped gently to the ground. Great was the applause from the wondering spectators, for though they had confidence in the wisdom of the Montgolfiers, they did not expect to see a man-made device rise so high and rapidly into the thin air.

In August, of the same year, came the famous flight from the Champ de Mars when, for the first time, the word "ballon" was given to an aerostat. The filling began on August 23, 1783, at Place des Victoires, but as the tremendous crowd proved unruly at times, it was moved on the night of August 26, to the Champ de Mars, a distance of two miles. The balloon being escorted to the new location by a detachment of foot and horse-guards, with lighted torches, proved such a weird spectacle that the cab drivers stopped their carriages and knelt humbly, hat in hand, while the procession was passing.

J. M. Montgolfier, inventor of the balloon. Born at Annonay, France, 1740. He died in 1810.

In the morning, the Champ de Mars was thronged but patrolled by the troops. At the discharge of a gun, the highly ornamented globe rose to a height of 3,125 feet in two minutes and then entered the clouds. The heavy rain that then descended did not impede the progress of the ascension, much to the further astonishment of the spectators, and after remaining in the air for 45 minutes, it fell in a field near Gonesse, a village 15 miles from the Champ de Mars.

The sight of a body leaving earth and travelling in space was sublime, and because the body apparently defied the laws of gravity, the spectators were overwhelmed with enthusiasm. Ladies decked out in the latest fashions allowed themselves to be drenched with rain to avoid losing sight of the sphere for one minute. This event proved to be a great sensation in all countries and ballooning became an international fad. Among the spectators to this event was Benjamin Franklin who was greatly impressed with what he saw.

But no man had made an ascension with a balloon until 1784 when M. Pilatre de Rozier and the Marquis d'Arlandes ascended in a hot-air balloon and passed over Paris in it. They remained in the air for about half an hour and then descended with little damage to themselves or the balloon. In this balloon, the air was kept hot by means of a fire carried in a pan just below the mouth of the bag. In earlier experiments, de Rozier ascended in a captive balloon to the height of 80 feet.

Everyone was now working on balloon improvements and development proceeded rapidly. A huge balloon, 126 feet high, ascended with seven passengers late in 1784. It burst at a height of 3,000 feet, but descended with little damage to the passengers.

But on December 17, 1784, we note the most important development of them all in the balloon ascension of Robert and Charles using a hydrogen balloon which took them to an altitude of 10,000 feet. The physicist Charles, coated his balloon with a rubber solution to close up the pores in the fabric. He also used a net for strengthening the bag and supporting the basket, and

employed a valve at the top of the bag to permit descent.

Thus, in the early balloon of Charles we have all of the elements of a modern balloon, the spherical bag, the net, the basket, the valve and the hydrogen lifting agent. For more than a century, the construction remained practically the same except for improved methods of inflation, improvements in the design of the valves and the introduction of the rip-panel.

But getting way back to the beginnings of the balloon, we find many investigators who had the correct idea but who could not put their ideas into practice. For example, we have Albertus Magnus, born about A. D. 1190, who actually proposed a vapor filled bag but who also proposed a rather energetic propellent for it. He writes:

"Take one pound of sulphur, two pounds of willow charcoal, and six pounds of salt ground very fine in a marble mortar. Place, when you please, in a covering made of flying papyrus to produce thunder.

"The covering, in order to ascend and float away, should be long and graceful, well filled with this fine powder, but to produce thunder, the covering should be short, thick and half full."

From the nature of this composition, we should imagine that there would be plenty of thunder, because it is very similar to gunpowder, and would explode when ignited with a match.

The huge balloon or "aerostatic machine" completed by J. M. Montgolfier and flown near Lyon, France, in 1784. It was 100 feet in diameter and 126 feet high. It burst, but its seven passengers landed safely.

Father Vassou, a missionary at Canton, China, in a letter dated September 5, 1694, mentions a balloon that ascended on the coronation of the emperor Fo-kien in 1306. Possibly, this was a sky-rocket and not a balloon at all, for the Chinese have been adepts at fireworks for hundreds of years.

Then we get down to Dr. Black, Edinburgh, Scotland, who as early as 1767, suggested that a thin bladder could be made to ascend if filled with "inflammable air," as hydrogen was called in those days. Cavallo, in 1782, succeeded in sending up a soap bubble filled with hydrogen gas.

But, in spite of the many proposals, the Montgolfier Brothers were the first to make a practical demonstration, and further, to make it in public and before witnesses.

Because of the nature of the hot-air balloon or "Montgolfier," as circus people still call it, it was not possible to make very long flights with this type. The hot-air soon cooled off after the balloon lifted from the furnace, and because of its weight, it was impracticable to burn fuel while in flight. For short jumps, as at public exhibitions, however, it is so successful that it is still being used today.

The hydrogen balloon of Robert and Charles was more practicable, and with this type of balloon, distances of 1,800 miles have been obtained with one filling. Duration with these balloons is largely a matter of preventing the diffusion of the hydrogen through the fabric or eliminating leaks. From this point, the next step was, naturally, an attempt toward providing it with motive power.

The first balloon flight in Great Britain was made by Tytler, Edinburgh, Scotland, who made an ascension with his "fire balloon" on August 27, 1784. To quote from a letter written by a spectator to this flight:

"Mr. Tytler is now in great spirits and in his turn, laughs at those infidels who ridiculed his scheme as visionary and impracticable."

Any article on the history of ballooning is not complete without mention of the celebrated French aeronaut, Lunardi. Lunardi, a London Showman, took off in his fire-balloon a few weeks after Tytler made his ascent. He made many subsequent ascensions and his name is connected with the earliest history of "air-meets." Lunardi was the first aeronaut to have the name "professor" tacked before his own name.

Lunardi, in his first ascension, broke up the king's council in an abrupt manner. When seated among the members of his chamber, the King was informed that Lunardi was about to ascend. "Let us put aside these matters for the moment," quoth His Majesty, "We can resume them at our leisure, but may never be able to see poor Lunardi again."

This is the first hydrogen balloon of Robert and Charles, rubber coated and very similar to a modern gas balloon.

A modern hydrogen balloon of 1932, not very different from that of Robert and Charles.

What About Levitation-Yes or No?

by JOHN B. RATHBUN

Here are our readers' opinions, taken fresh from their numerous letters, on the subject of Levitation. The author has supplemented each comment with his reply — given in good faith and with a basic truth to support it.

AS MIGHT be expected, a flood of correspondence followed my recent article on Levitation. Some of the letters were denunciatory, some congratulatory, some mildly critical, some suggestive of improvements, some abusive while the remainder were quite constructive and thoughtful.

All in all, it was a revelation to read these letters and to ponder upon the motives of the writers. Some ridiculed the idea just as it has always been a human trait to ridicule any innovation of a radical nature, without any basic reason for criticism. Others presented arguments based upon a more or less elementary knowledge of physics and mechanics, while others displayed the drawings of levitating devices upon which they had been working for some time prior to the publication of the article. We read of all sorts of ideas, positive and negative, that could be applied to the subject.

Now, the idea of levitation is not so very new—a number of patents have been granted on levitators—but it seems new to the average reader because very little publicity has been given to this branch of flight. Many minds have been and are bent upon the invention of a lifting device which is independent of air reactions or buoyancy, but so far as known, nothing of a practicable nature has yet been developed. Who knows, however, what tomorrow may bring forth?

The whole matter of Levitation is surrounded by great mechanical difficulties, no one understands that better than the writer, but that does not mean that the problem cannot be solved ultimately. The design of the airplane defied the ability of scientists for ages and then within a few years, it became nearly as familiar as an automobile. Sometimes, radical ideas crystallize into practicability overnight and it is not for me to say, nor anyone else for that matter, that levitation is or is not just around the corner.

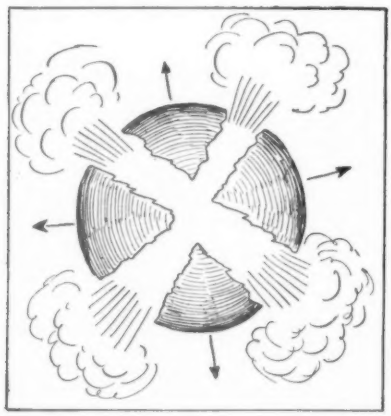


Fig. 1. A shell bursting in air throws the fragments in every direction, independent of air reactions or earth connections. Thus is levitation in brief.

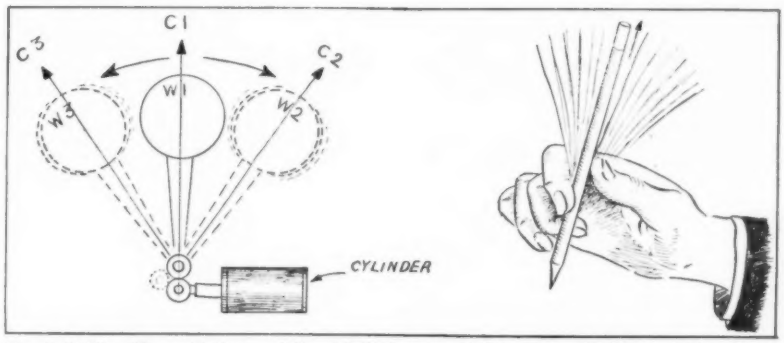


Fig. 2 (Left). The oscillating centrifugal levitator suggested by James McGillan. Lifting forces are at C1-C2-C3. Fig 3 (Right), shows a simple experiment that demonstrates Mr. Gillan's principle.

For down in our hearts we all know that the present airplane does not represent the final solution of the flight problem—not by a long way. Its many imperfections and vagaries are so well known that it seems hardly necessary to enter into a discussion of these shortcomings. Something more reliable, safer, less expensive and easier to operate must succeed the winged airplane, the Autogiro, or any other airship that depends upon the uncertain road-bed of atmospheric air for its sustention. This may be Levitation or something entirely different, but air supported vehicles of the present day are doomed.

Based on the principle that a structure is no more stable than its foundation, it seems quite doubtful whether any sort of air-supported vehicle can be made positive and absolutely stable when carried upon the uncontrollable atmospheric current variations. On the other hand, Levitation offers the advantage of opposing the force of gravity without first going through the medium of a turbulent fluid to do it, hence this or a similar method would seem to be the logical method to pursue. It directly opposes the acceleration of gravity by another equal and opposite acceleration of compact bodies carried within the vehicle and is therefore independent of atmospheric conditions.

As explained in my article, the diagrams submitted did not represent proven means of acquiring lift. I do not claim to have solved the problem but simply pointed out methods of producing forces that can be applied to this method of support. However, at least two of them in modified form will show some reduction of weight although not a sufficient reduction to lift the entire weight of the apparatus. For example, the modified belt-driven machine, when placed on the scales weighed 47 ounces with the motor dead. With the motor running, the scales show 22 ounces, or a net lift of 25 ounces. The main difficulty at present is the tremendous vibration, but it is likely that this can be overcome by more careful workmanship and balancing.

And now to answer the correspondents who have favored me with so much attention—adverse and otherwise.

* * *

JOHN C. CARNEY, Lincoln, Nebr., doesn't like the idea of Levitation a-tall, and says so frankly and openly.

Of all the dam fool ideas I have ever heard of, this levitation stuff takes the cake. Anybody knows that in order to get up in the air you must have something to push against and air is just as cheap for this purpose as anything else. The airplane, the balloon and the dirigible are all supported by the air so why worry about anything else. Phooey on this Levitation stuff.

Oh, very well, Mr. Carney. But just tell me please why a rocket will work in a vacuum without anything in particular to push against. In fact, a rocket is more efficient in a vacuum than in the open air at sea-level. A bursting shell (see Fig. 1) will throw pieces high in the air without atmospheric support.

* * *

THEN comes a high-school lad, Roy Winters, Miami, Fla., who is all hot and bothered because he has discovered two accelerations, up and down, which he believes will neutralize each other.

Here's his slant on the system.

In one drawing you show that a downward acceleration of the weight produces lift and this is O.K., but when it comes to rest at the bottom of the tube, it de-accelerates and thus produces an opposite acceleration that undoes the lifting effect of the first acceleration.

Which goes to show that Roy didn't read carefully, but as about forty 'leven other guys came to the same conclusion, we'll answer the letter anyhow. It is intended to have the downward acceleration several times greater than the de-acceleration, hence the lifting force will be greater than the downward force. As you probably know—or don't—the force is proportional to the acceleration rate.

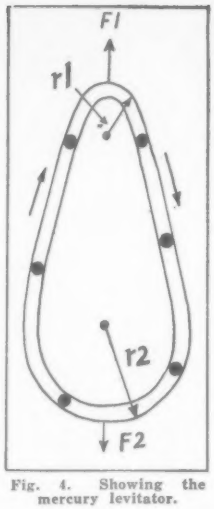


Fig. 4. Showing the mercury levitator.

* * *

NEXT, on a well filled docket, is Bertram Clarke, San Diego, Calif., who doesn't believe in levitation because he never saw it.

There is nothing in nature that indicates that the levitation idea is correct. Nature gave wings to birds and insects and didn't fill them full of revolving weights. When you can show me something natural that works on the levitation scheme, then I will believe it.

You are quite correct, Bertram. Nature did not put revolving weights in the gizzards of birds. But then, neither did Nature put wheels on horses and cows. No one can say that automobile wheels are failures just because they do not occur in nature.

* * *

OUR friend, J. C. Higgins, Lockport, N. Y., rises in his ire to give me a slap on the wrist for the levitation article, and in so doing, gives himself two slaps. Not that I care—but I thought I would just mention it.

That article on levitation was an insult to the intelligence of your readers. How a perfectly good aviation magazine can descend into that drivel is beyond me. In the first place, the idea of levitation is all wrong because in lifting a weight, we must in some way, push against the ground. In the second place, you make the statement that fragments of a flywheel are thrown high in the air by an acceleration. Nothing of the kind. They are thrown by centrifugal force. Why don't you acquaint yourself with the facts before publishing articles.

If you will look into any book on physics, Mr. Higgins, you will find that centrifugal and centripetal forces are due to accelerations. In other words, a weight traveling in a circular path is continually being accelerated into a new direction, the forces being due to these accelerations. Each particle in the rim, or spoke of the flywheel, is continuously changing its direction and this change of direction calls for an infinite series of accelerations and a continual application of a force.

In regard to your other statement, you make the same error committed by many others. The lifting force must react against the force of gravity and not necessarily the material earth itself. It makes no difference how the earth's attraction is overcome, by direct contact or in space.

* * *

JAMES McGILLAN, Cleveland, Ohio, has done quite a little experimenting along these lines for the past five years and is, therefore, a believer in the future of Levitation even though he has not yet successfully cracked the nut.

Your article on Levitation was very interesting to me, doubly so because I have been experimenting with this sort of apparatus for the past five years. I have had no overwhelming success with my Levitators, but the results show that great possibilities lie along this line and I am always confident of success.

I am sending you a sketch of my most successful device (See Figs. 2-3) which has given a very pronounced lifting effect. It consists of an oscillating weight swinging about a center and traveling, therefore, in a circular arc. When in motion there is a lifting force (F) due to the centrifugal force. I have developed a lift of 9 pounds with a one pound swinging weight, but the device has never lifted from the ground because the motor and the rest of the apparatus weighs about 11 pounds.

You can try this experiment yourself by simply oscillating a lead pencil between your fingers as in Fig. 3. The pencil will be pulled out of your fingers, if held loosely, by the centrifugal force.

Very fine, Mr. McGillan, you, like all others who have played around with this idea, cannot help seeing that someday we will fall upon the combination that will do the trick.

* * *

NOW, we will tune in Mr. A. Barry Taylor who claims residence in Little Rock, Ark. He is a kindly soul who does not wish to bear down too hard on me and so he recounts my good deeds as well as my alleged misdemeanors. Here we are:

I have followed your writings with great pleasure in POPULAR AVIATION, *and I have always agreed with your*

(*Concluded on page* 414)

New D. of C. Head is Appointed

Eugene L. Vidal who has recently been appointed to take charge of the aeronautic activities of the Department of Commerce.

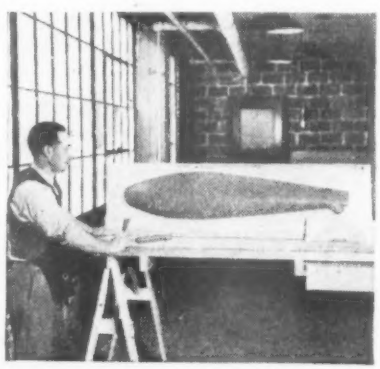
SECRETARY OF COMMERCE, Roper, has recently appointed Eugene L. Vidal to take care of the Aeronautics Branch of that bureau to succeed Clarence Young. He will have the title of Director of Aeronautics.

It is to be hoped that Mr. Vidal, in the discharge of his new duties, will see fit to adjust the present difficulties of the aviation amateur, the aeronautic experimenter, and others, who have suffered at the hands of the former regime.

He Molds 'em In Clay

IT IS sometimes very difficult to visualize the shape of streamline bodies as indicated by drawings, and still more difficult to properly make understandable drawings.

Therefore, the Boeing Airplane Co.'s engineering department has resorted to sculpture or clay modelling for picturing the fuselage and other elements of the plane. Here we see a fuselage molded in clay by an engineer.


This shows how the various streamline forms are worked out on the molding board.

Wing Icing Problems Studied

How the N. A. C. A. is conducting research work on one of aviation's greatest menace — the icing of the wings. Much is being learned in this laboratory as to how the ice is formed and how to handle the problem.

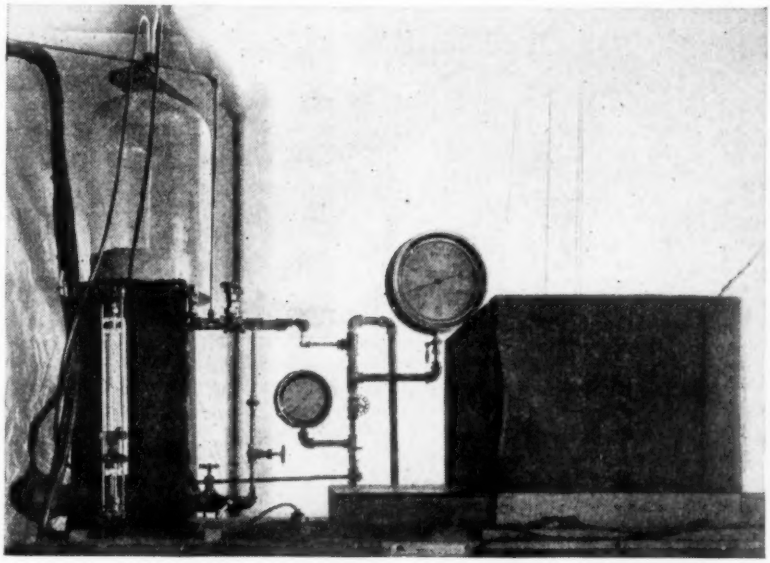
AT LANGLEY FIELD, the proving ground of the National Advisory Committee, the wind-tunnel was connected with a great refrigerator unit capable of blowing intense cold air against the wings of planes.

The search was for some sort of coating that might be applied to the airplane before it left the field which would discourage the icy blasts of Old Man Weather.

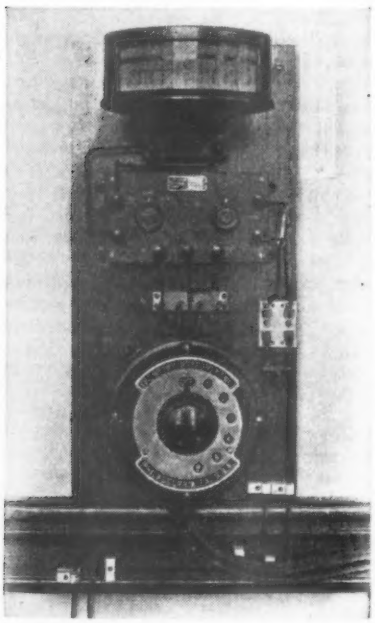
The formation of ice on aircraft in flight presents a serious hazard. The danger arises partly from the increased weight, but more particularly from the deformation of the aerodynamic shapes causing decreased lift, increased drag, excessive vibration and finally loss of control. The wings, wires and struts are the parts most seriously affected.

Aviation engineers have sought for methods that would overcome the ice hazard. There appeared to be two general ways which might prove satisfactory. One is "prevention," which includes the use of surface applications and heat which will prevent ice from forming. The second is "avoidance," which includes adequate weather forecasting over air routes and the use of suitable instruments to enable pilots to either stay on the ground, fly around a storm area or above the area.

But the mails must go through, regardless of the weather, thus scientific engineering determined to discover, if possible, a way of discouraging the ice from sticking to the wings, the wires, the struts and other parts.



The apparatus used for producing and controlling the water spray used for duplicating, so far as possible, wing icing conditions.



The panel holding the apparatus of the highly accurate resistance thermometer.

This problem proved far more complex than it sounded and has meant much research. The behavior of water when subjected to sudden changes in temperature is quite well known, but a plane suddenly dashing into a cold area can not stop and its very speed is adapted to the sudden appearance of ice.

There are three general atmospheric conditions which cause three corresponding types of ice formations on airplanes. These are temperature inversion, mild supercooling and high supercooling.

The first, known as temperature inversion, is a condition that exists during an ice storm. Such a storm brings about the sudden appearance of ice on exposed parts. The ice is smooth and glassy in appearance. Anyone who has driven an automobile during bad weather, with the temperature low and the air heavy with moisture, knows how the ice forms on the windshield in solid form—hard and almost impossible of removing. Sometimes the ice is mixed with snow and sleet and then it is formed in ridges and is rough.

There are numerous temperature combinations of the air, and rain which may produce ice on exposed surfaces, but the best known is when the air suddenly goes below the freezing point and rain is falling from comparatively warm clouds at a higher altitude. Under such conditions, ice will surely form on any exposed thing that happens to be in the colder region. In the case of an airplane flying in such a region, ice forms and builds up rapidly on all leading edges. This ice gives a blunt nose which soon breaks up the smooth air flow over the surfaces, reducing the lift, increasing the drag and making an immediate landing necessary.

When ice piles up on the wing surfaces, it may do it so quickly that the pilot has no time to rise above it or to safely land and so the danger is great. Storms of this sort are quite common in the northern half of the United States and Canada.

Another condition that brings about ice is when a cloud or mist is found at an air temperature which is one or two degrees below freezing. In this case, the surface tension of the water particles is great enough to overcome the tendency to freeze. When the airplane runs into the cloud or mist, striking the tiny particles, they quickly freeze, giving a glaze formation similar to an ice storm, except that it is generally more moderate and does not deform the surface of the plane so quickly.

When running into icy mist, a pilot may keep on going for a little time, perhaps never realizing his danger, but all the while the ice is piling up and

collecting on wings and wires. Suddenly, he notices that there is a marked vibration in his plane and a sluggishness of the controls and he is having trouble in maintaining altitude. When that happens, the danger is great for it is too late to climb over the bad place.

The third condition which reports of air mail and transport flyers tell about is encountered in fog or mist which is several degrees below freezing temperature. In such a condition the water particles are highly supercooled. As soon as the airplane comes in contact with these particles, they freeze upon the surfaces instantly, and have the appearance of snow. It is not snow, but white, hard, crystals of ice. These build out forward from all exposed leading edges giving them a sharp-nosed shape.

The aviator has been unable to do more than "take a chance" on the temperatures which bring his dreaded foe, ice. Ambitious pilots have often tried different methods to see if the ice could be discouraged from forming. Others have gone in for instruments which would warn them when approaching dangerous regions of ice, but even such instruments do not help to get the plane and its load through on time.

A number of years ago a small wind-tunnel was set up at McCook Field and connected with a refrigerated room, for the purpose of studying the effect of ice on tubes. But this did not include the whole plane and nothing that was satisfactory was discovered.

It was announced recently that Dr. W. C. Geer and Dr. Merit Scott of Cornell University had worked out a device known as an "overshoe" which could be laced over the leading edges of the wings. It is made of rubber, impregnated with a special oil. The idea is to reduce the adhesion between the ice and the rubber. Within the shoe are ducts of air to which a pulsating air pressure is applied. This alternately inflates and deflates the "overshoe" thus keeping the ice away.

This shoe method is very much as if an auto tire was running through icy weather and was being pumped up and let down so as to keep the ice from sticking to it.

Now at Langley Field it was desired to find some coating that would stop or at least discourage the ice from forming and which coating would not add to the weight of the plane and its equipment. Thus a refrigerated wing tunnel was made especially for the purpose of studying the matter of coatings on wings and wires.

This tunnel was a complicated affair, so arranged that the air could be lowered to below freezing or icy water could be sprayed into the air. A giant propeller made the air circulate quickly.

In order to simulate clouds or rain, cold water was injected into the air by

(*Concluded on page* 411)

QUESTION AND ANSWER DEPARTMENT

All questions of general interest on any phase of aviation will be answered authoritatively by POPULAR AVIATION'S Technical Staff.

View of cumulus clouds in the process of formation, a white fleecy cloud very frequently seen in summer. These clouds vary greatly in height and thickness.

QUESTION:—Harry Demick, Defiance, Ohio. *What were the leading features of the "Tanager," the prize winner in the Guggenheim safety contest?*

Answer:—IT WAS provided with wing slots and flaps and also with independent ailerons known as "floating ailerons." The slots and flaps reduced the stalling speed while the floating ailerons were more effective near stalling speed and thus reduced the tendency toward spinning because they gave equal resistance on both ends of the wings.

* * *

QUESTION:—J. N. McNair, Covington, Ky. *What is meant by the abbreviation—b.h.p.?*

Answer:—THIS abbreviation stands for the expression "brake-horsepower." In other words, this is the actual maximum power delivered when the engine is tested on a brake that absorbs the power developed by the engine.

* * *

QUESTION:—Jesse T. Schoenhofen, Newark, N. Y. *Can an Autogiro climb and descend vertically like a balloon? The machines that I have seen always take a short run forward.*

Answer:—IN calm air, the Autogiro must run forward. It cannot lift vertically from a standstill unless it is facing a breeze. The revolving blades of the rotor are really nothing more than very effective wings that respond more quickly to translational air than the stationary wings of a plane.

* * *

QUESTION:—Roy France, Toledo, Ohio. *What is the difference between the basic load, the design load and the applied load?*

Answer:—THE basic load is the weight of the complete airplane alone. The design load is the greatest probable load multiplied by the safety factor. The applied load is the actual load to which any part of the plane is subjected in any condition of flight or rest under consideration. The load factor is the ratio of any applied load to the basic load.

* * *

QUESTION:—Matthew Mattern, Omaha, Nebr. *Please tell me how the gliding angle of an airplane or glider is determined. Does this depend upon the weight or upon the type of wings?*

Answer:—THE best or flattest gliding angle, without power, depends primarily upon the ratio of the total drag of the wings and the structural parts to the total loaded weight. Thus, if (W) is the total weight and (D) is the total drag, then the ARC Tangent of the gliding angle is equal to D/W.

* * *

QUESTION:—A. P. Henderson, Minneapolis, Minn. *Please give a description of cumulus clouds, their appearance and formation.*

Answer:—CUMULUS clouds are the woolly dazzling white clouds with towering peaks and flat bottoms, the bottoms being somewhat darker than the rest of the cloud because of being in the shadow of the upper part of the cloud. They are formed by the condensation and freezing of the moisture in upward vertical currents of air.

* * *

QUESTION:—Edward V. Halle, Phoenix, Ariz. *What is meant by the phrase: "Catastrophic instability?"*

Answer:—WITH some of the early airplanes there were two angles of attack at which the ship was in equilibrium. One point of equilibrium corresponded to the position of normal horizontal flight—the most stable condition. The second posi-

(*Concluded on page* 413)

Solo Pilot License Abolished

THE solo pilot license is abolished and the solo flying privileges of that grade are extended to student pilots by the terms of an amendment to the Air Commerce Regulations. The next higher grade above student pilot now is the private license and the requirements and privileges pertaining to the private grade are not changed.

No new solo licenses will be issued, but persons now holding licenses in that grade may retain them and operate under the privileges and restrictions originally granted until qualifying for private licenses, or until the solo licenses expire.

Curtailed appropriations have necessitated the discontinuance of itineraries for Department of Commerce aeronautical inspectors, thereby making it necessary for the applicant for a license to fly to the base of the inspector for his theoretical examination and flight test.

Under this procedure, if the solo license were to be continued, many pilots with 10 hours of flying experience would find it necessary to make cross-country flights in order to reach inspectors for their tests. The solo grade, therefore, was abandoned inasmuch as the test given for the grade is not of sufficient value to justify requiring a cross-country flight to be made at this stage in a pilot's career.

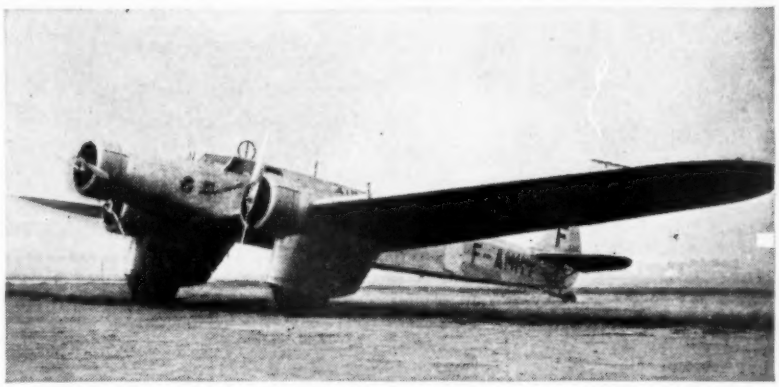
Students, under the revised regulations, may make solo cross-country flights, and have all other privileges formerly accorded solo pilots, with one exception. Student pilots when piloting aircraft may be accompanied by no persons other than licensed transport, limited commercial or private pilots. Solo pilots may fly in company with other licensed pilots in any grade, including solo pilots.

This extension of the student's privileges is a part of the Department's present policy of relaxing restrictions upon private flying whenever this can be done with proper regard for safety.

The Department requires of the student pilot only that he pass a physical examination to make certain that there is nothing in his physical makeup which will prevent him from becoming a competent pilot. He then may begin receiving instruction, and under the present amendment, may make solo cross-country flights as soon as he and his instructor feel that he has had sufficient experience.

It will not be necessary for him to present himself to an aeronautical inspector for examination and flight test until he is prepared to qualify as a private pilot. As heretofore, student pilots may not carry any passengers until passing the private pilot examination, and the requirements for that grade are not changed. Fifty hours of accredited solo flying and accomplishment of a theoretical examination and flight test are the prerequisites for a private license.

The French Air Mission to Moscow



The French all-metal Dewoitine tri-motor monoplane, a highly original design.

FOLLOWING close upon the heels of former Premier Edouard Herriot's visit to Russia, the French Air Ministry sent a delegation to Moscow. This was headed by Pierre Cot.

They were carried by the all-metal Dewoitine tri-motor monoplane shown here which has many points of interest. Most prominent, perhaps, are the tremendous "pants" which extend downwards from the engine nacelles. A considerable amount of dihedral has been incorporated into the wings, and in many respects, the engine and landing gear arrangement rather reflects recent American tendencies in transport design. The hoop above the cockpit is the typical European directional radio loop. This loop can be oriented for directional signals.

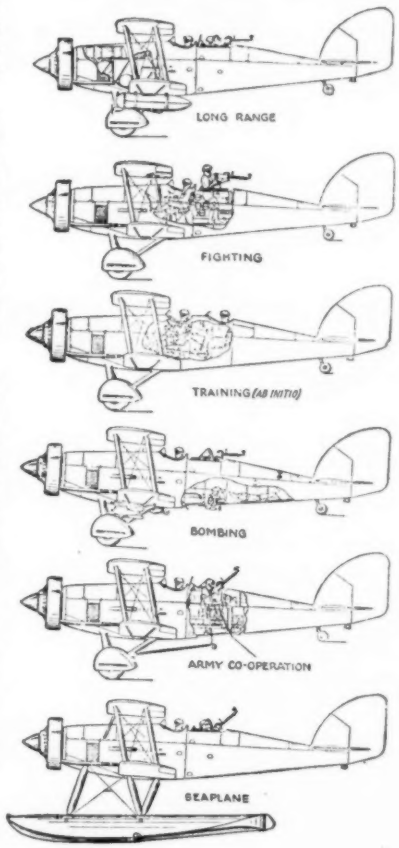
The Westland Wallace All-Purpose Plane

FOR THE past few years there has been a decided tendency toward the design and construction of the "all-purpose" military plane, even among the air forces of larger nations.

This trend, no doubt, has been induced by the rigorous steps taken all over the world toward economy in military operations and both England and the United States have been leaders in the development of the all-purpose airplane. For the smaller nations, having only a limited number of planes, the all-purpose type is also exceedingly useful as it can be quickly converted into a type that might be urgently needed on short notice.

Prominent among the planes of this class is the Westland Wallace, a British production shown here in its various phases of military usefulness. It is about as versatile as any ship that we have seen and can be converted into anything from a fighter to a hospital ship, or from a landplane to a seaplane.

The saving lies in the fact that only a relatively few specialized aircraft need be employed for the various purposes, the convertible planes filling out the bulk of mission. This means economy in equipment, in the stocking of spare parts and replacements and greatly simplifies the maintenance of the fleet. To stock a great many parts for various classes of machines calls for a great outlay of money and complication in handling.



EDITOR'S NOTE. *We wish to thank the English aeronautical paper, "The Aeroplane," for these sketches.*

The Stearman Biplane Model 81

(See Cover Drawing)

Complete specifications and description of the high-speed utility plane known as the Stearman "81," the successor of the better known Model 80.

THIS plane is a high-speed utility plane for the use of the sportsman pilot and which can be employed for mail carrying within the limits of its size. It is a conversion of the Model 80 with a few slight changes.

As shown by the accompanying photographs, drawings, and also on the cover of this issue, it is arranged as a 2-place plane provided with a very convenient cockpit cover, but the ship can also be supplied as a single-place job. When desired, it can also be converted into a seaplane by substituting double pontoons for the landing gear.

In general, its construction follows conventional practice with a fabric covered steel tube fuselage and a wood wing structure which is also fabric covered. The landing gear is wire braced and is provided with oleo-shock-absorbers, the axle being eliminated by the arrangement of the stays. A steel tube frame tail-group, fabric covered, is attached in the usual manner and is wire braced.

The Stearman Model 81, is regularly equipped with a Wasp Jr., Model T3A engine, rated at 420 h.p. at 2,200 r.p.m. A Hamilton Standard controllable pitch propeller is also standard equipment. One feature to be specially remarked is the easily accessible N. A. C. A. cowl, a special Stearman design.

Directly ahead of the front seat is a large and conveniently arranged baggage compartment which is provided with a quickly accessible fire extinguisher. This compartment has a capacity of approximately nine cubic feet, which under standard conditions, carries 96 pounds with pilot and passenger or 266 pounds with the pilot alone. The standard gasoline tank capacity is 104 gallons but an additional 50 gallon tank can be added with corresponding changes in the personnel or pay loading.

Among the miscellaneous standard equipment are the adjustable parachute type seats, elastic engine mounting, electric starter, generator and battery (12 volt), 24 inch streamline tires, and a very complete installation of instruments. The framework and powerplant are bonded and shielded for the radio equipment.

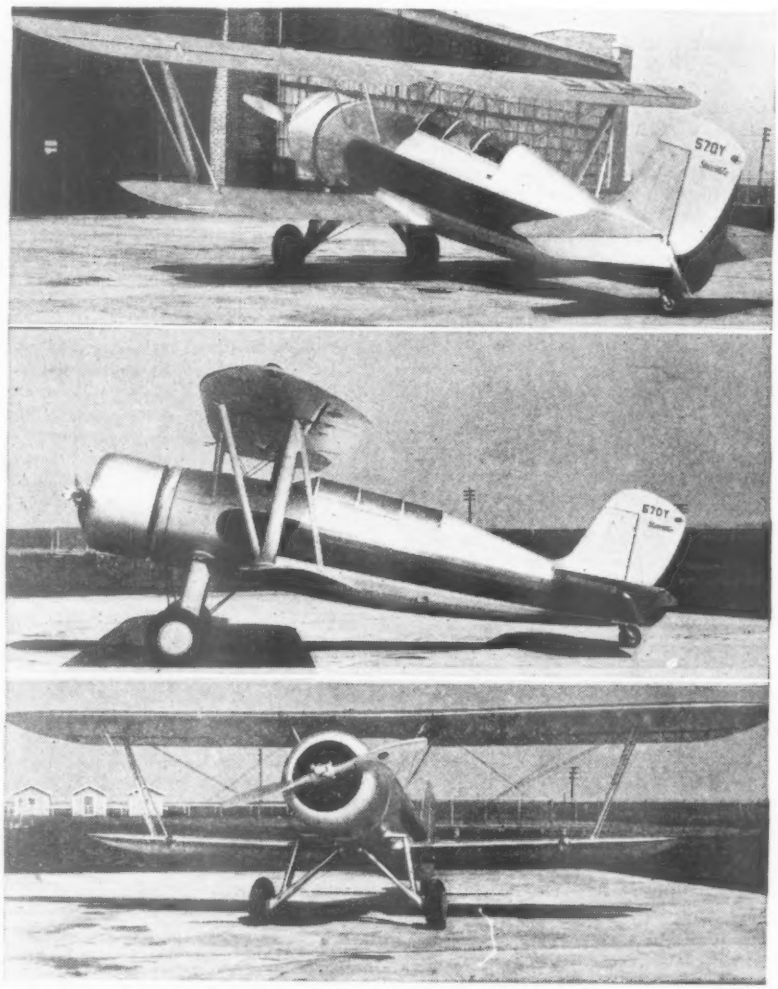
The following loading distribution is made for a flying range of 650 miles, certain changes being possible, of course, from the scheduled loadings.

WEIGHTS AND LOADING

Weight empty, with all equipment	2,380 lbs.
Useful load	1,120 lbs.
Pay load (104 gals. gas)	266 lbs.
Gross weight	3,500 lbs.
Gas capacity of main tank	69 gals.
Gas capacity of reserve tank	35 gals.
Total normal maximum gas capacity	104 gals.
Wing loading, per sq. ft.	12.72 lbs.
Power loading, per h.p.	8.33 lbs.

Figures on the performance and the general dimensions will be found on the scale drawing laid out on the opposite page. Here it will be noted that a greater dihedral is given to the lower than to the upper wing, and that the lower chord is smaller than that of the top wing. Stagger and overhang are both employed in the wing cell, and the cell is strongly braced by a highly effective "N" strut of original design.

Very substantial fittings and connections are employed throughout with special attention being paid to the hinging of the ailerons, rudder and elevator. There is nothing radically new in the design, it is simply a well thought out and well fabricated standard type of airplane.

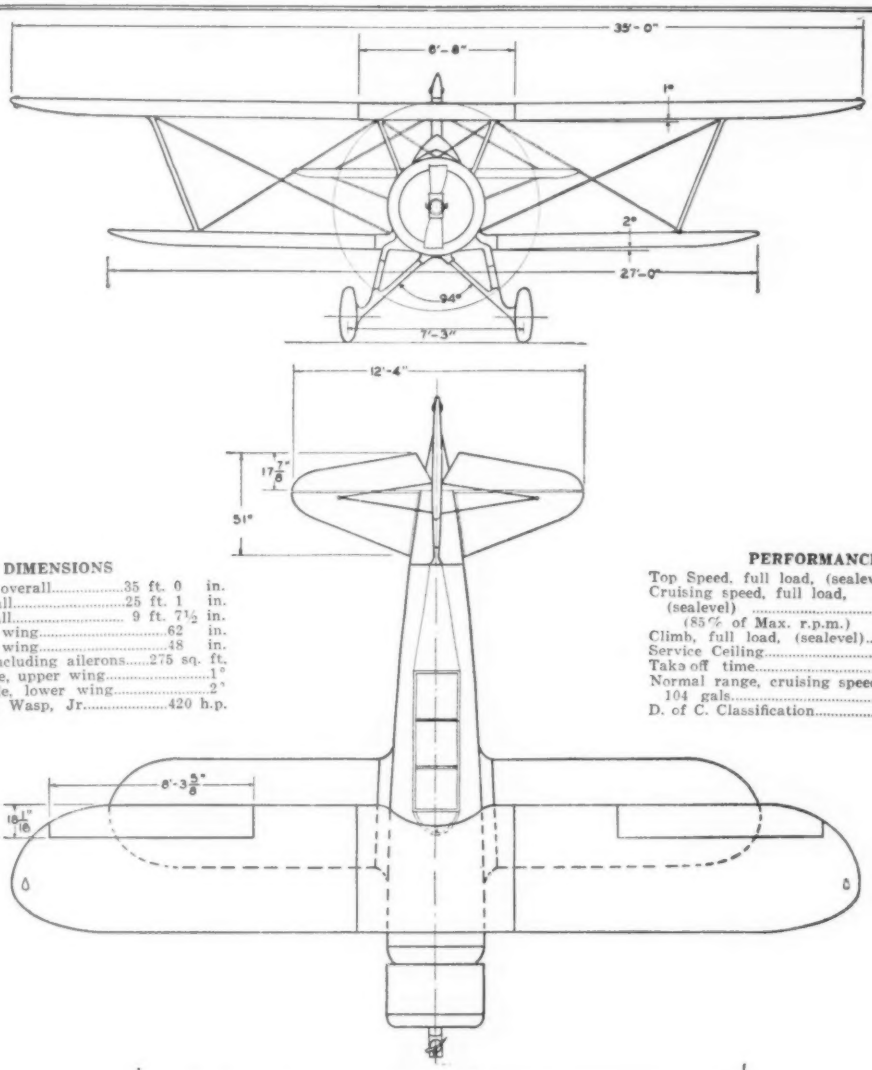


Three views of the Stearman Model 81 Biplane. Note the neat cockpit enclosure and the symmetrical appearance of the ship.

EDITOR'S NOTE. *The above description and specifications, as well as the originals of the drawings on the opposite page, were kindly supplied by the Stearman Airplane Company. We wish to announce that the drawings for a scale flying model of the Stearman 81 will be printed in the next issue of P. A.*

Scale Drawings of the Stearman 81

These drawings have been reproduced directly from the manufacturer's drawings and will be found accurate and authentic in every respect.

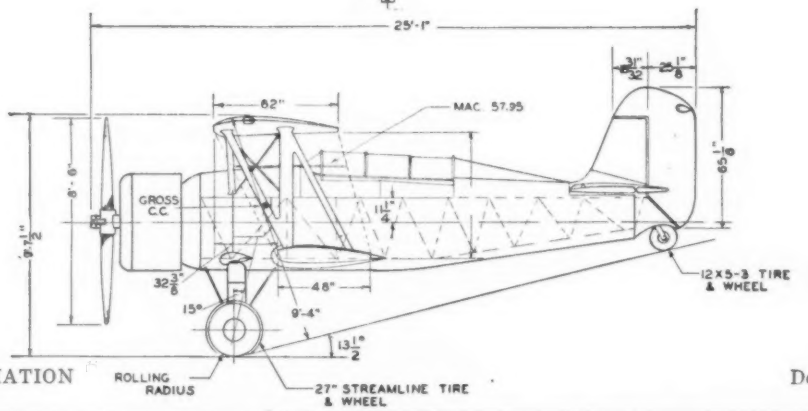


DIMENSIONS

Wing span, overall	35 ft. 0 in.
Length, overall	25 ft. 1 in.
Height, overall	9 ft. 7½ in.
Chord, upper wing	62 in.
Chord, lower wing	48 in.
Wing area, including ailerons	275 sq. ft.
Dihedral angle, upper wing	1°
Dihedral angle, lower wing	2°
Power plant, Wasp, Jr.	420 h.p.

PERFORMANCE

Top Speed, full load, (sealevel)	175 m.p.h.
Cruising speed, full load, (sealevel) (85% of Max. r.p.m.)	151 m.p.h.
Climb, full load, (sealevel)	1600 f.p.m.
Service Ceiling	19600 ft.
Take off time	10 sec.
Normal range, cruising speed, 104 gals.	650 miles
D. of C. Classification	2POLB



Another Steam Driven Plane is Ready

View of the new steam plant.

AKRON, OHIO, is now the scene of more developments in steam driven airplane experiments. This latest addition to the steamers is a plant invented by Erick Beckley and Harold Johnson who have installed the steam engine in a small monoplane.

They will start the flight tests within a short time and we will try to get some more information on the subject for our steam fans. It is said that the generator contains only three quarts of water and that the improved burner will bring the pressure up to the flying point within three-minutes after the flame is started. Crude oil is being burned as a fuel.

American Pilots Are Polite

NORMAN D. NAIRN, managing director of the Nairn Transport Company, Beyrouth, Syria, has been in the United States studying American air line service. Mr. Nairn has had a wide experience in long distance flying in almost every country of Europe and is well qualified to make the following observation:

"The courtesy, intelligence and efficiency of American pilots, co-pilots and ground personnel are so far ahead of similar features on European lines that there is no comparison. It is apparent that no effort is being spared to give the American people the utmost in air travel comforts and service. Healthy competition plus characteristic American aggressiveness are working wonders to the benefit of American air travelers."

Mr. Nairn's Syrian transport company does not confine its activities to the air but operates almost every known type of transport vehicle, including camel trains, trucks and airplanes.

Dust at 2000 Feet

YOU wouldn't expect to get dust in your eyes in an airplane flying at an altitude of some 2000 feet between Jamaica and Miami, Florida, but Pilot Roy Keeler did the other day.

When he landed his big flying boat at Dinner Key Base, it looked as though it had just been driven down a dusty country road. Keeler said he collected dust all the way across the Caribbean and offers as his explanation that it must have been volcanic dust wafted across his path by an easterly breeze blowing from the smouldering heights of West Indies craters.

Gold Moves by Air

PROBABLY the most valuable cargo being transported by airplanes today is from the rich diamond fields of the Belgian Congo. It is estimated that the planes are carrying more than a quarter of a ton of diamonds annually from the Kasia fields, one of the largest and least known treasure lands in the world.

In the days of caravan and rail, the journey from the mouth of the Congo River to the diamond district required six weeks. With the coming of the roads, autos made it in three days. Now the airplane traverses the distance in one short day.

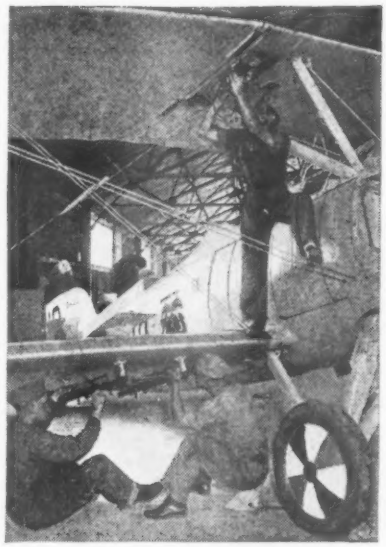
Indian Invents Landing Platform

YOSEMITE NABONA, a Navajo Indian born in Arizona but educated in Europe, has devised this magnetic airplane brake which enables the roof of any building to be used for a landing field so long as this roof is flat and has a surface 100 x 100 feet.

Long magnets, pull on the tail skid of the airplane, bringing it to a stop very quickly. This magnetic turntable is mounted so that it will always face the wind in the proper position for making the landing.

Here is the Nabona Magnetic platform.

Marines Are Fitting Up Their Ships



The U. S. Marine Corps are busily fixing guns and bomb racks.

HERE is a typical view at Quantico, Va., where the mechanics of the U. S. Marine Corps are fixing up the planes for possible service in Cuba.

In the picture, they are installing bomb racks on the lower wings of a Hell-Diver while machine guns are being mounted on the upper wings.

Teaching the Novice to Fly

TO know an art is not necessarily to know how to teach it; teaching is itself an art. This truism we have only now begun to apply to the teaching of amateurs to fly.

Hitherto, any air pilot holding a license to fly was free to set up in business as an aeronautical instructor. Henceforth, a professional teacher will have to hold a certificate as such, issued after an examination by the Dept. of Comm. The examination test will embrace every detail of flying which a novice must be taught in order to qualify for an amateur pilot's license.

First, the would-be instructor will be examined orally to ascertain his powers of accurate and lucid exposition; he will have to answer many "Hows" and "Whys." Next he must take his examiner into the air and, treating the latter as a novice, must instruct him in any of 18 different maneuvers as chosen by the examiner.

Four of these tests will be compulsory in all cases,—i. e., how to take-off and to land across wind, how to recover from any sort of spin, and how to make a forced landing. The main object of the test is to raise the standard of private flying and to lessen the danger of incompetent amateurism at a time when private flying is being widely taken up. To license the instructor is decidedly a step in advance as a safety measure.

The Douglas DC- 1 Transport

by CHARLES R. RUSSELL

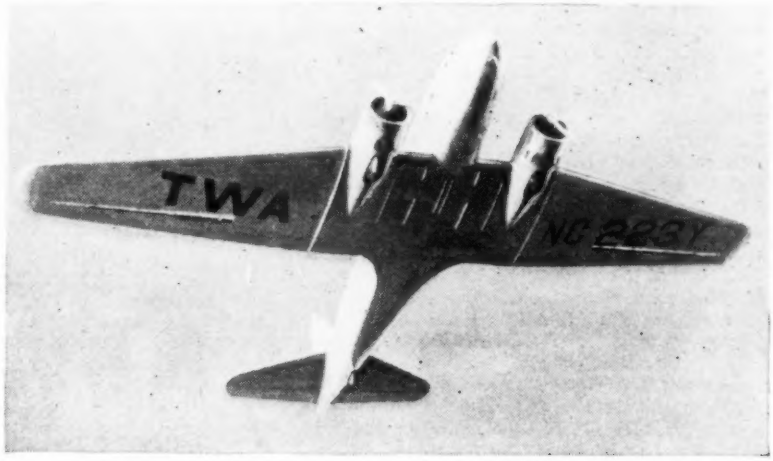
This is the latest addition to the twin-motored low-wing monoplane transport group to pass its flight tests, and it is a decidedly well designed job throughout.

A NEW all-metal twin-engined airliner, known as the Douglas DC-1, has attracted much attention because of its size and speed. The first ship, out of a total order of 21 similar planes, has just successfully passed its flight test in which it displayed a remarkable performance.

The Douglas DC-1 was built and designed for the Transcontinental and Western Air, Inc., by the Douglas Aircraft Co. and its subsidiary, the Northrop Corporation, under the specifications of the TWA. It is a low-wing cantilever monoplane powered with two Wright Cyclone 1820-F-3 geared engines, each developing 710 h. p. at 8,000 feet altitude. The top speed at 12,000 feet altitude is 210 m. p. h. while the cruising speed is 186 m. p. h.

Twelve passengers are seated in two rows of six seats per row, but the width is sufficient to permit the seating of 18 persons without crowding. Ample head-room of 6 feet 3 inches is provided while the inside width of the passengers' compartment is 5 feet 6 inches. A cargo compartment in the nose has a capacity of 1,000 pounds, while a compartment for the passengers' baggage is provided at the rear. The total normal payload is 3,400 pounds with a gross weight of 17,500 pounds.

Entrance to the passenger compartment is through a door on the left side, and to the rear of this door is the buffet and the lavatory. The buffet is provided with an ice-box and with facilities for serving meals while in flight. The cockpit accommodates the pilot and co-pilot while the radio equipment is at the rear of the fuselage, this arrangement giving space for more seats than would be the case with the radio outfit in front. As the wing beams pass beneath the fuselage, there are no structural parts visible nor are there any obstructions in the cabin.



Showing the under portions of the Douglas DC-1 while in flight. The wheels are retracted and it presents a remarkably clean appearance.

The passenger compartment is soundproofed by the use of Seapak so that the sound level at cruising speed is below 70 decibels, comparing favorably with the noise rating of Pullman cars in which the ordinary noise level runs about 60 to 65 decibels. The seats are mounted in rubber to absorb vibration which adds further to the comfort.

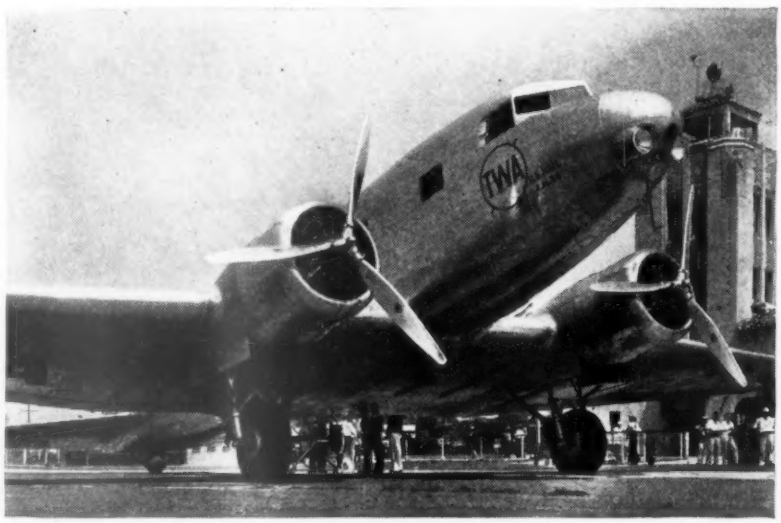
Nearly all of the structural work is composed of the new 24-S alloy which is used in bars, sheets, tubes, castings and extruded forms. The strength of the new alloy is considerably greater than that of similar aluminum alloys, giving a much better structure with greater rigidity and better riveting properties. The interior of the passenger compartment is lined with a washable fabric which acts in conjunction with the soundproofing system.

A thermostatic controlled steam heating and ventilating system holds the interior temperature at 70 degrees F. even with the outside temperature down as low as 20 degrees F. below zero. The ventilating air is led by ducts from the nose to the cabin, cockpit and lavatory. The ventilation is controllable.

An interesting wing is employed, a cellular multiple web construction developed by John K. Northrop and used on the Northrop "Alpha" ships. The center section of the wing is part of the fuselage structure and also serves as a support for the retractable landing gear and the engine nacelles. The wing section is tapered from an N. A. C. A. 2215 at the root to the N. A. C. A. 2209 at the tips of the wings. The outer wing sections are bolted to the center-section by a bolted flanged joint. The center section also carries two 180 gallon main gasoline tanks and two 70 gallon auxiliary tanks. The main tanks are fitted with dump valves controlled from the pilot's cockpit.

The engine nacelles are of the monocoque type with the engines supported

(*Concluded on page* 420)



The front elevation of the Douglas DC-1 which shows the tremendous size of the ship compared with the persons walking about it.

The Ashmusen Engine

MANY years ago, a very efficient air-cooled engine, known as the Ashmusen engine was developed in this country and in its time attracted a great deal of attention.

The cylinder arrangement and the fluted cooling system was highly effective, so effective indeed that no difficulties were experienced in cooling inline cylinders. The flutes, running lengthwise of the cylinder, were connected together at the head, and through these flutes the carbureter intake air was carried into the engine. Ribs were also run around as in the modern engine to assist the flutes in cooling.

As will be seen, the hollow longitudinal flutes served two purposes. First, the carbureter air drawn through the flutes serves to cool the cylinders, while in the second place, the air was thoroughly warmed so that it greatly improved carburetion. It was repeatedly proved by many flight tests in different kinds of ships that the cooling was perfectly satisfactory under the most grueling conditions.

The Ashmusen engine was built as a double opposed engine with banks of cylinders lying opposite to one another on opposite sides of the crankcase. The largest engine was an eight cylinder opposed engine with four air-cooled cylinders in each bank.

Early in 1908, Henry W. Ashmusen started his experimental work, and later provided successful engines for the early Wright biplane owned by George Beatty, and for the Bleriot XI plane owned by Stanley Y. Beach. He was one of America's early pioneers and deserves recognition for his engine developments. However, Mr. Ashmusen died before the engine reached commercial production and since that time, the commercial development was entirely in the hands of his widow.

First Air Ride at 103

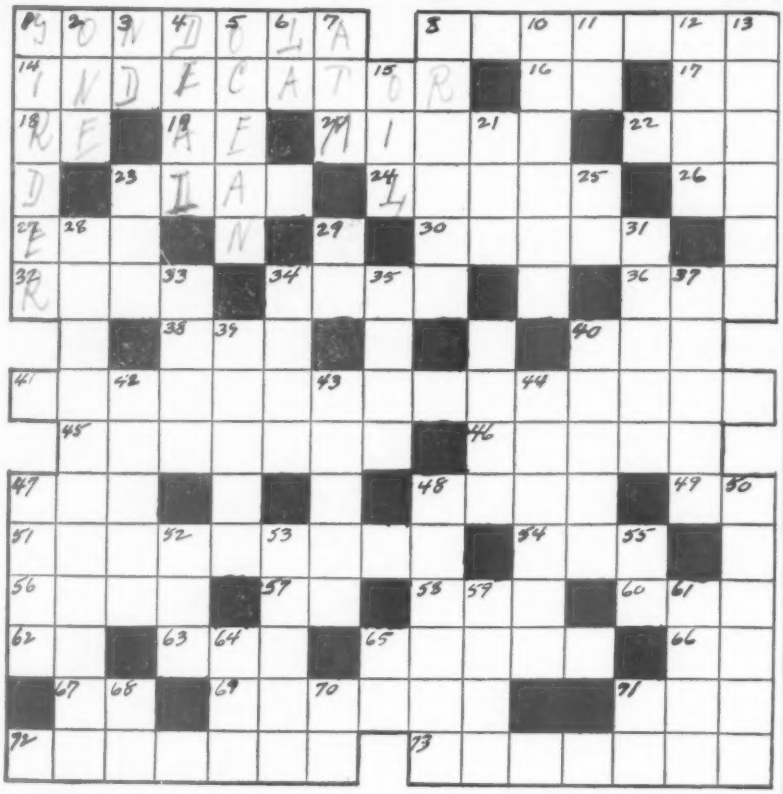
SOME time ago, Elijah Lane, who claims that he is 103 years old, expressed a desire to ride in an airplane. In fact, he expressed the wish as his one strongest desire, and the desire came to the notice of the manager of the Municipal Airport, in Tulsa, Okla., who arranged for the ride.

A broad grin settled over the wrinkled face of the old man as the plane left the ground, and his praise of the, to him, novel conveyance was great. He declared that he could ride it clear to California, or anywhere else. "It beats a team or mules or even an automobile," he said, "If I hadn't looked out the window, I'd never known that we were moving."

This incident recalls one of the old-timers who took an air-trip last year along the trail on which he had driven a covered wagon way back in 1847 during the California gold rush.

Aviation Cross-Word Puzzle

by ERNEST W. FAIR



HERE is an aviation cross-word puzzle for our puzzle fans, so get out the old lead pencil and hop to it. The answers to the puzzle will appear in our next issue.

HORIZONTAL

1. The car of an airship or dirigible.
8. Last name of famous lady aviatrix.
14. Name of compass whose indications depend on current generated in a coil revolving in the earth's magnetic field.
16. Close by.
17. Word denoting surprise.
19. Aeronautical Engineer (abbrev.)
18. Word used in law to refer to something.
20. Type of airship.
22. Wood used in early airplane construction.
23. An extra strip of canvas—they use them on balloons to keep rain from running into the basket.
24. Black and blue.
26. Northwestern University (abbrev.)
27. Age.
30. Approaches.
32. To hire—airplanes may be hired in larger cities if you have a limited commercial license.
34. What occurs after a crash if the ignition is not turned off.
36. One of the country's largest air lines.
38. Wartime flyer who brought down five or more enemy airplanes.
40. Spanish word for 'Saint'—Kelly field is located near a city half of the name being this word.
41. What aviation magazine has the largest sale of any aviation journal published?
45. Toward the side (an engineering term in common use in aviation).
46. Pale.
47. Slang word for German soldiers during World War.
48. To close tightly.
49. Man's nickname.
51. How the privates stand when the General is reviewing them.
54. Clever.
56. To expose oneself to injury—stunt pilots do it every time they go up.
57. Salutation.
58. To inquire.
60. American war medal for bravery (abbrev.)
62. Famous Italian river.
63. Yale College is often known as "Old ——."
65. When things happen in your sleep you do this.
66. Two letters that mean everything is all right.
67. On what continent is the United States situated (abbrev.)?
69. A bird—the Curtiss Airplane company named a plane after it.
71. Society Automotive Engineers (abbrev.)

(*Continued on next page*)

72. Tiny bit of land surrounded by water (plural).
73. Name of book written by Commander Richard E. Byrd after his Southpole flight.

VERTICAL

1. These are what give a dirigible strength.
2. Smallest number.
3. Bismark is the capital of what state? (abbrev.)
4. Training planes have —— controls.
5. What did the trans-Atlantic flyers have to fly over?
6. Length (abbrev.)
7. Without this there would be no such things as airplanes.
8. What gives the plane the power of flight?
10. Type of motor.
11. Height (abbrev.)
12. Things get wet when this falls from the sky.
13. The driving force of the propeller when mounted on the plane.
15. Airplane engines should always have plenty of this to keep parts in good condition.
21. Contraction for "I have."
23. This cools things off on a hot day.
25. Doctor (abbrevation).
28. Each time the motor turns the propeller around the act is called a —— (plural).
29. Tiny word used to designate two winged plane.
31. Smear.
33. How the canvas on plane wings must be before being doped.
34. Any man who possesses this trait should never fly his own plane.
35. Actual.
37. Positive electric pole.
39. Valves should always be kept—.
40. Maneuver where nose of plane is turned upward until angle of ascent is so steep that the engine no longer pulls.
42. Slang word used to denote wheel coverings on modern planes.
43. Every air-liner has one now.
44. Wiley Post nosed his ship over here —— but it was repaired in time to break his round-the-world flight record.
47. What the pilot who got too careless is now playing.
48. Tangles.
50. Moored.
52. To drain slowly.
53. First, second—and then what?
55. Yard (abbrev.)
59. To look for.
61. What the glider does when in the hands of an expert.
64. Man's name.
65. To accomplish.
68. First name of 1928 Presidential candidate.
70. Part of verb "to be."
71. On what continent is the southern terminus of the Pan-American Airlines? (abbrev.)

END.

The Potez Convertible Monoplane Type 49

by FLETCHER PRATT

This is the Potez 49, a military plane that can be converted from a monoplane to a biplane depending upon the mission that it is to accomplish.

ONE of the most interesting of the new French military machines is the product of the Henry Potez factory, the Potez 49 which can be either a monoplane or a biplane, depending on the mission it is intended to accomplish.

It is an all-metal machine, powered with a Hispano-Suiza "12-Hb" of 500 h.p. The upper or monoplane wing is of cantilever construction, consisting of metal caissons, each separate in the Gerin manner, built up on the longerons. It is supported by a "V" strut running to the bottom of the fuselage.

In this condition, it is intended to be used as an observation machine, the high-wing and great speed specially fitting it for this purpose. In addition, when used as a monoplane, a third seat is available behind the normal observer's seat, which can be occupied without interfering with the use of the twin machine guns mounted on the rear turret.

When it is desired to use the same machine as a bomber, it can be accomplished in fifteen minutes by the attachment of a second wing below the first, converting it into a biplane bomber of greater load capacity. The lower wing, which attaches at the base of the fuselage, is fitted with prolongations of its longerons which lock into joints in the fuselage and are held in position both by an ingenious joint and by bolts.

As a further provision for solidity, a double-strut at each end connects the lower wing with the upper, locking into the upper wing at the point where the V-strut joins it in the same manner the longerons lock into the fuselage.

The machine has numerous other interesting and ingeniously contrived new features. Both wings are of the new L2R alloy which is so much employed in French aviation lately and both are provided with a separately-movable leading edge which fulfills the functions of a wing-slot. The ailerons are all on the upper or monoplane wing and are attached to the rearmost of the two main longerons, the controls being carried through the longeron itself. Stress-points both in the wings and in the fuselage are strengthened with special metal plates and all of the assembly is riveted.

Another special connection permits the inflation of the tires from the pilot's seat while the machine is either in flight or on the ground. It is connected with the compressed-air gear which operates the starter and wheel-brake system.

Normally, the Potez 49 carries an equipment of 3 machine guns, two on the rear turret. As a monoplane observation machine it is equipped with photographic and radio apparatus, 3 parachutes and signalling devices. As a bomber it can carry 4-100kg (220 lb.) bombs or smaller bombs up to the same weight. A third use is foreseen for the machine in the French possessions in Africa, where several of them have already been attached to the trans-Sahara air units of the French army. For this purpose the machine carried radio and photographic equipment, arms for ground use, munitions and provisions as well as camping equipment, a reserve fuel tank, and a third passenger.

SPECIFICATIONS

Wing spread (maximum)	52′ 6″
Length	32′ 10″
Height	10′ 2″

Total weight

As monoplane	As biplane
3,857 lbs.	3,974 lbs.
804 lbs.	1,211 lbs.
832 lbs.	976 lbs.
4,593 lbs.	6,161 lbs.

PERFORMANCE

As Monoplane

Speed (ground level)	147 m.p.h.
Speed (11,000 feet)	139 m.p.h.
Climb to 3,200 ft.	3′30″
Climb to 11,000 ft.	14′30″
Ceiling	22,600 ft.
Radius of action	546 miles

As Biplane

Speed (ground level)	130 m.p.h.
Speed (11,000 feet)	122 m.p.h.
Climb to 3,200 ft.	4′15″
Climb to 11,000 ft.	16″
Ceiling	20,990 ft.
Radius of action	484 miles

Winter Sport With an Auto

Driving a wind-buggy through the snow and being towed behind on skiis are the king of sports.

FROM December to March, the Emigh snow plane, a propeller powered snow auto, is the one means of transportation to points in and around Walden, Colorado, isolated because of snow choked roads where train service stops when the first snow begins to drift.

It has proven its value in transporting mail, food and other supplies to snow bound territories, and it is indispensable to state officials making inspection tours. Many times it has rushed doctor and medicine to ranch homes.

The snow-taxi requires no road or trail, can navigate the highest drifts, and when the snow is over the fences, it takes the shortest route to a given point. It is driven like an auto, steered as an airplane by the tail rudder. It has an average speed of fifty miles per hour. A cabin similar to a plane's protects driver and passengers from wintry weather.

Where the snow plane is used, it does away with the necessity and expense of opening roads after each storm. It is believed it will come into general use in all regions where the snow blocks traffic during winter months. Also, it will be welcome in the Yukon and parts of Canada where dog teams are exclusively used today.

Aside from its urgent need in snowy regions, it is hailed as a pleasure plane by neighbors and friends of Harold Emigh, the inventor. During the Winter Sports Carnival held at Steamboat Springs, last winter, the Snow Plane was a leading feature.

Queer Purchases by the Air Corps

TWENTY-FOUR soldiers recently drafted into the U. S. Regular Army, for an indefinite term of service, have established for themselves the reputation of being Uncle Sam's most perfect soldiers, according to information just released by the War Department.

They do not drink, smoke, nor chew. They obey orders instantly, and never stir from their assigned posts until properly "relieved." They refuse to accept pay for their services, and are not constantly awaiting "chow call"—a comm n characteristic of soldiers not so perfect.

Three squads of them, strong, alert, and—made of lead. For exactly $4.22, the Air Corps supply officer at a western airfield recently purchased these recruits, together with ten leaden artillery caissons, 12 gasoline trucks, ten tractors, and 6 Army trucks. The small recruits and equipment are intended to replace "veterans" on the miniature bombing range which affords indoor practice for advanced flying students at the field. The retired veterans have rendered "honest and faithful service in the Army of the United States" for many years, some of them dating back before the World War.

Another freak purchase recently made at the same Army post was a number of fishing poles. These were not, as might well be supposed, intended as equipment for Izaak Walton's followers, but serve an important part in the training of flyers. Messages are suspended on strings tied to the ends of two upright fishing poles, and pilots, flying low, pick them up by means of a hook which dangles at the end of a fishing line.

Notes for the Photo Phans Club

IN REPLY to the re-dedication ceremonies in the November issue of P. A., we have had a host of letters from new picture fans and our old standbys.

And to sum the matter up, they are all on deck and rarin' to go. So, to appease the bunch, we are going to make a promise. In short, this is to the effect that P. A. is going to carry the best airplane pictures during the coming year than it has ever done, and you must acknowledge that this is some promise in view of what has been done already.

For the birds who use airplane pictures for the decoration of their dens and rooms, we will furnish the full page photos. For the members that keep scrap-books and the like, we'll have a big bunch of smaller pictures. Some fellows would like to have a few wartime planes in the full page series. What do you think of this, or would you rather have modern ships?

We wish we had room to reprint all of the interesting letters that we have received this month, but we will be compelled to limit ourselves to a few because of lack of space. Here they are.

* * *

Fred Bamberger, 817 West End Ave., New York, N. Y., believes that our cover illustration should be a full view photo of a modern plane and not a drawing. Drawings are more revealing then photographs. To assure absolute accuracy, the drawings are always submitted in advance for inspection by the manufacturer.

* * *

Ed T. Benson, ????, Iowa, suggests that we tell the Phans about his scheme of using pictures for a decorative effect. He has mounted many of his photos, grouped artistically, upon the walls of his den and has covered them with sheets of glass taken from old counters and show cases. After covering, he runs a wood moulding around the glass and thus produces wall panels that are highly interesting. The glass protects the photos and preserves them better than books or files. Good idea, Ed.

* * *

B. Harris, Hildon, England, has written us a pleasant letter in which he tells us that he is an enthusiastic collector of all sorts of airplane pictures. We are pleased to enroll him as a member of the Photo Phans club and hope that the English chapter or affiliates, whichever you wish, are successful in trailing down rare shots of planes.

* * *

And now comes Kip Cooper, 337 N. Croft, Hollywood, Cal., who is herewith made a member of the club. He would like to contact members living near the Boeing, Curtiss, Consolidated and Berliner-Joyce airplane factories. Well, Contact!

Practical Lessons in Aviation

by JOHN B. RATHBUN

And now we take up the all important subject of air resistance or the opposition encountered when bodies are moved through the air. This is the most important phase of aviation physics.

NEARLY everyone has had some experience with air or wind pressure, so that it will not surprise many of my readers to hear that moving air can exert a very considerable force on objects placed in its path.

Trees and buildings are leveled by windstorms, umbrellas are turned inside-out by high winds, high waves are produced on the surface of bodies of water and other familiar manifestations of wind pressure are frequently with us. And we also understand that the higher the speed of the wind, the greater will be the pressure or force produced.

As Einstein would put it, the action of moving air on objects in its path is purely relative. It makes no difference whether a moving air-stream flows around a stationary object or whether the object moves with the same velocity through "still" air. The pressure produced will be the same in either case. The pressure of air moving at 15 m.p.h. against the body of a standing cyclist will be exactly the same as the pressure against his body when he is pedaling his bicycle against calm air at the same speed.

For 200 years, or more, investigations have been conducted on wind pressure and many theories have been advanced as to its cause, but it is only within comparatively recent times that any consistent theories and accurate quantative formulae have been arrived at. The first investigators were architects and bridge engineers who obviously were concerned with the air pressure loads placed on their structures by high winds. From this point on, the matter was gradually taken up by those persons whom it concerned even to a greater extent—the designers of flying machines.

With only crude measuring apparatus at hand, the architects arrived at only approximate results which were not applicable to all conditions—nor in particular, to flight conditions. At first, only the so-called "Newtonian Theory" was advanced which erroneously assumed that the total pressure on the surface was due simply to the impact of the air particles, each particle creating a pressure by giving up its energy when striking a solid surface. This is comparable to the pressure or force exerted when a projectile strikes a surface.

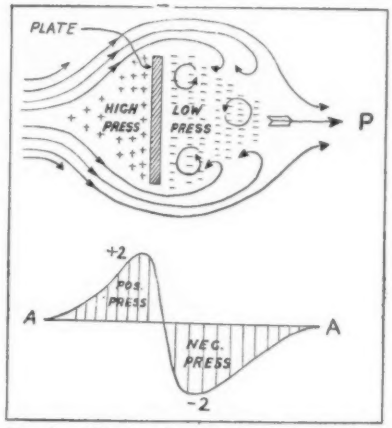


Fig. 1. (Above). Showing the turbulence and pressure distribution around a flat plate in a wind stream. (Below). Pressure diagram.

By observing the flow of liquids and smoky air around various objects, it was later discovered that the Newtonian Theory was in error because it did not take several factors into consideration. While it was true that the pressure increased with the square of the air velocity, and also with the weight or mass of the air, yet the final effects were also found to be governed by the nature of the air flow about the object, upon the shape of the object and upon its relative proportions.

Tests indicated that a relatively high impact pressure is produced on the face of the object meeting the wind and that a greatly reduced pressure, or a partial vacuum, is created at the rear face or leeward side of the object. Some shapes produced a greater turbulence or commotion of eddies in the air than others, giving a great difference in the character of the flow and also in the pressure produced. Instead of being simply an impact of air particles on the front face, the total effective pressure is really due to the difference in pressure between the front and rear faces of the object.

This condition is indicated in Fig. 1 where the air-stream is moving from left to right, over and against a flat plate held at right angles to the air-stream. On the left face, presented to the stream, the impact of the air creates a pressure above the surrounding atmospheric pressure and the air stream then sweeps around the plate to the rear. As the air-stream cannot immediately close together at the rear, because of its inertia, a vacuous space is left at this point, filled with whirling air eddies known as "turbulence."

Pressures above atmospheric pressure, at the left, are considered as "positive pressures" and this zone is indicated by small "plus" marks (+). A partial vacuum, or pressure below atmospheric, is considered as a "negative pressure" and this zone is indicated by the small "minus" signs (−). Just below the plate is a small diagram showing the approximate pressure variation, the positive pressure on the front of the plate being assumed at (+2) while the low pressure at the rear is below the atmospheric pressure line (A-A) and is taken at (−2).

Therefore, it is obvious that the total pressure (P) acting on the plate is the difference between the high and low pressures on the front and rear of the plate, respectively. This pressure varies considerably with the shape of the plate, whether square, round, elliptical, etc., and also with the proportions of the length to the width called "aspect ratio." The pressure taken in pounds per square foot, is multiplied by the area in square feet to obtain the total pressure acting on the whole surface.

Still another factor entering into the pressure is the density of the air or the weight of the air per cubic foot. It is therefore evident that the pressure of the air against the plate will not be as great at high altitudes, where the density is reduced, as at sea-level where the density is greater, all other conditions remaining constant. Unless otherwise specified, the standard sea-level density of 0.7651 pounds per cubic foot will be assumed in all calculations.

Now, while we have referred to the

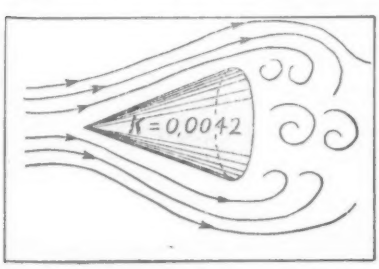


Fig. 2. With the apex of the cone facing into the wind, the resistance is high because of the great turbulence.

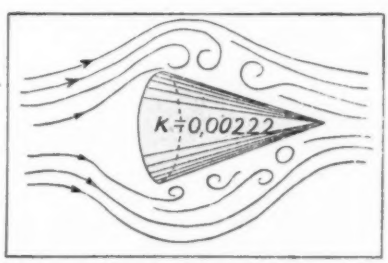


Fig. 3. With the base of the cone presented to the wind, the resistance is reduced because of the smoother flow.

effects of the air-stream as a "pressure," this is more frequently called "resistance" in aviation because it represents a force that resists the movement of an airplane or airship through the air. It is this force that the engines must overcome in propelling the airplane.

If the resistance gives no return benefits, it is called "parasitic resistance." The resistance of the fuselage, landing gear, etc., is parasitic resistance because it simply wastes power, but this is not the case with the resistance or drag of the wings, part of which is due to the useful lifting effort in carrying the load. More will be said on this subject later.

In the actual calculation of the resistance of an object, we multiply the area in square feet by the square of the velocity in miles per hour (or feet per second), and further multiply this product by a coefficient that represents the shape, size and proportions of the object. A number of different units are in use, some metric and some English but for the time being we will use the coefficient based on square feet and feet per second. The formula reads:

$P = C \times A \times V^2$ = Resistance in pounds.

For square flat plates, presented at right angles to the wind and for areas greater than 12 square feet, the coefficient (C) can be taken as 0.00152 with standard air density. Thus, we have:

P = Resistance of plate in pounds.

C = 0.00152 = Coefficient of resistance corresponding to a square flat plate of more than 12 square feet, at right angles to the wind and under standard air conditions.

A = Area of one side of the plate in square feet.

V = Air velocity in feet per second. One mile per minute is equal to 88 feet per second.

Just for example, let us assume that we have a square flat plate having 20 square feet of surface presented to the wind, the wind having a velocity of 100 feet per second. The resistance becomes:

$P = 0.00152 \times A \times V^2 = 0.00152 \times 20 \times (100 \times 100)$

$= 0.00152 \times 20 \times 10{,}000$

$= 304.0$ pounds.

Thus, the engine must overcome a resistance of 304.0 pounds to force this plate through the air at the given speed. But if the speed is increased to 200 feet per second, or is doubled, just note the tremendous increase in the resistance.

$P = 0.00152 \times 20 \times (200 \times 200) = 1{,}216$ pounds.

In other words, simply doubling the speed gives us four times as much resistance! It is for this reason that the resistance producing area must be cut down to the lowest possible point at high speeds to avoid a great loss of power.

When we double the speed, the plate not only strikes the air twice as quickly and harder, but it also comes into contact with twice as much air in the same length of time. Thus, within ordinary limits, the resistance increases: V x V times or as the "square of the speed." At speeds below 100 m.p.h., the loss by parasitic resistance is relatively small.

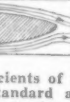
FIG.	NAME	BODY	VALUE OF K
A	SPHERE		0.00044
B	HEMISPHERE FLAT FORWARD		0.0038
C	HEMISPHERE RD. FORWARD		0.0081
D	SHORT CYLINDER FLAT FORWARD		0.0019
E	LONG CYLINDER FLAT FORWARD		0.0020
F	SHORT CYLINDER SIDE FORWARD		0.00092
G	LONG CYLINDER SIDE FORWARD		0.000121
H	CYLINDER WITH ROUND ENDS		0.00060
I	STREAMLINE WIRE		0.000085
J	STRANDED CABLE		0.000144
K	STREAMLINE BODIES		0.000067 To 0.000094

Fig. 4. Resistance coefficients of several simple geometrical bodies in standard air. Note the direction of the wind in respect to the body axes.

But, if the area of the plate is less than 12 square feet, we must make a correction to the above results. The resistance of the plate will be less and as this is not a regular decrease, it will be best to give the reduction factors in tabular form. Thus:

SIZE CORRECTION FOR FLAT PLATES

Area Sq. Ft.	*Factor (F)*
10	0.990
8	0.980
6	0.973
5	0.968
4	0.954
3	0.930
2	0.914
1.5	0.906
1.0	0.898
0.5	0.880

We use the above factor (F) as a multiplier for the coefficient of plates having an area of less than 12 square feet. Thus, for an area of 3-square feet, the factor is 0.930 which will be used for multiplying the coefficient 0.00152 to get a corrected coefficient. Then:

CORRECTED COEFFICIENT (C′) $= 0.00152 \times 0.93 = 0.001413$. The corrected coefficient, 0.001413, is now used in the resistance formula just like the original coefficient.

Having made this correction, there is still a further correction to make for flat rectangular plates. This is the correction for "aspect ratio" or the ratio of the length to the width of the plate. It should be understood that the aspect ratio (r) is the ratio of the length (L) to the width (b) in Fig. 5, or: $r = \frac{L}{b}$.

The resistance with a high aspect ratio is relatively greater than with a square plate, or in other words, a long slender rectangular surface presents more resistance than a shorter stubby surface.

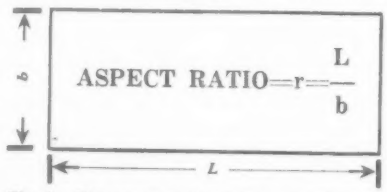


Fig. 5. The aspect ratio or the proportions of the length to the width of a plate.

ASPECT RATIO CORRECTIONS

Aspect Ratios (r)	*Factor (D) Correct*
24	1.35
20	1.32
18	1.30
16	1.275
14	1.245
12	1.180
10	1.148
8	1.120
6	1.100
5	1.080
4	1.060
3	1.050
2	1.040

To correct for aspect ratio, the coefficient (C′) is multiplied by the factor (D) above, where it will be seen that an aspect ratio of 24 increases the resistance by 35 per cent. Thus, if a flat area must be presented to the air-stream, it should be nearly square rather than long and narrow for the least resistance.

As an example in the use of both corrections, for size and aspect ratio, let us say that we have a surface with 3-square feet and an aspect ratio of 8. The wind velocity is to be 100 feet per second. Looking at the tables we see that the size factor is 0.93 while the aspect ratio factor is 1.12. First, we correct the coefficient 0.00152 before going further.

Corrected coefficient $= 0.00152 \times 0.93 \times 1.12 = 0.001583$. The complete calculation for resistance then becomes, with the new factor:

$P = 0.001583 \times 3 \times (100 \times 100) = 47.49$ pounds.

If the speed is given in terms of miles per hour, then the coefficient (K) is 0.00327 for the square flat plate instead of C = 0.00152, but the correction factors will remain the same as before.

A flat circular disc presents less resistance under the same conditions than a flat square or rectangular disc because the section of the air-stream is

(*Concluded on page* 411)

Letters from Our Readers

Letters on all sorts of interesting subjects are received daily at the office of POPULAR AVIATION. A few of these letters will be presented each month on this page.

HERE, at P. A.'s office, we receive all sorts of letters on all sorts of subjects connected with aviation. All of them are interesting, some of them contain mighty good ideas while others are decidedly humorous.

Now, we have enjoyed this correspondence so much in the past that we have decided to print certain letters so that our other readers could enjoy these communications with us. In a way, this is a new department which will or will not be retained according to your wishes. We cannot hope to publish these letters in their entirety, for many of them are pages long, but instead, will abstract them and pick out certain paragraphs which we believe will be of the most interest.

If you have any suggestions to make on this department, we'd sure be glad to hear them. And so, here we go with the first collections in this new department.

* * *

"I have just finished reading, page 159, the controversy in your office regarding the so-called "mystery ship." This is an easy one. It is a Standard J-1 all fitted out with a Jenny nose plate, nose radiator and D. H. landing gear.

"This J-1 is one of the type with the wide ailerons. To adapt the JN4 nose radiator to the Standard J-1, the nose had to be widened to 27 inches and the upper longeron had to be dropped forward of the firewall to accommodate the OX5. The original J-1 had a Hall-Scott A7A engine bed. I own an old J-1, Identification No. 3015, one of the few old-time ships in the country, so I am pretty sure of my ground."—Ralph O. Deeter, 214 Court St., Mt. Pleasant, Mich.

* * *

"Do we want full page airplane pictures? I'll tell the world we do! The walls of my room are barer than a landing field. You see, that is what I do with the pictures—put them on the wall." Yours, 'till the kicker conks, Mervyn Chamberlain, Reedly, Calif.

* * *

"During the International Air Races in Chicago, Miss Klingensmith crashed in her Gee-Bee racer. The real reason for her fatal acident was more or less kept secret. It was due to negligence of that very efficient body of "damp rags" known as the Department of Commerce!

"Miss Klingensmith's Gee-Bee was designed for no more than a 300 h.p. engine, the original one being a Lycoming of 215 h.p. Miss Klingensmith, in order to step up the power, installed a Whirlwind of 420 h.p. Mr. Granville, the designer of the plane, tried to prevent her from doing this, but the "damp rags," for some reason or other did not stop her.

"The race she entered on Sunday was flown successfully by her, but on Monday she flew the pylons too hard and ripped off the leading edge.

"Why the Department of Commerce, better named the Department of Lightplane Fighters, does not pay less attention to the poor inoffensive lightplane fans and more to their beloved "big-shots" and pro-flyers, I do not know. But I do know that if the fans are given half a chance, they and they alone, will realize the dream of the airminded and popularize aviation."—Maurice Commanday, 18 Ridge Road, Yonkers, N. Y.

* * *

"In your Airy Chat for October, you asked for comments on the full size picture which you omitted a short time ago. May I say here that I am interested in aviation from the standpoint of traffic and promotion. These pictures helped me to identify airplanes just as the automobile advertisements helped me to identify their respective cars. May I suggest that instead of one to a page that you might place two pictures of a half page each. In this way, you would accomplish twice as much in the same space."—Donald W. Strevell, 811 Myrtle Ave., Albany, New York.

THIS is the first appearance of a department that we believe will be of interest and service to our friends.

Every month we will run representative letters, not necessarily the best letters, but those that come closest to representing the opinion of the majority. Our space is limited for this purpose, but we cordially invite you to contribute your opinion on any subject in which you are particularly interested.

* * *

"I wish to enclose this little complaint. I realize that you must receive scores like it, but if enough arrive, it will help. Like others who have written before, I too cannot help but criticize the government's ruling requiring a student to have 50 hours in the air. I too, think that the final test of the pilot's ability should be with the inspector.

"Just the fact that a student has fifty hours in the air does not make him any better than the quick thinking chap who can fly—say after ten hours.

"I am sure that many young men, who otherwise would be flying today and buying small lightplanes, are discouraged in the very beginning when they consider the cost of a private license."—Ted Fehrins, Palisade, N. Y.

* * *

"Your article by James Farber—"Wiley Jost—Circumnavigator," has a paragraph with which I cannot agree. This reads: 'He flashes no winning smile on you, as Lindbergh does, occasionally.' The picture that I have forwarded to you contradicts this very emphatically (It does—J. B. R.) as I am sure you will agree."—Richard Meyers, 610 Park St., Allentown, Pa.

* * *

"It seems a queer thing that certain wartime planes receive a lot of publicity, such as the Camel, Spad, Fokkers, etc., yet there are a whole lot of very interesting old planes that have had no mention at all in the public and aviation press.

"Now let me speak of a few of these old-timers that have not been introduced to the Photo Phans nor the model builders. The Breguet Pusher, Vickers Scout, Armstrong-Whitworth, Siemens-Halske, L. V. G., Ago, Halberstadt, Morane-Saulnier, Morane-Borel, Martinside, Salmson-Moineau, A. R., A. L. D., Rumpler, A. E. G., Letord, etc.

"It seems to me that model builders would get a lot of kick out of some of these ships which were really well put up and novel:"—Charles P. Underwood, 6227 Byron St., Chicago, Ill.

* * *

"As a reader of your magazine, I am making a request. I am sure that I speak for many aviation enthusiasts.

"It is hard to understand such articles as the one in the October issue of POPULAR AVIATION on "How to Locate Wings," if one does not have a complete knowledge of terms and definitions, such as Reynolds Number, pitching moment and center of pressure. It is my hope to see such an article in POPULAR AVIATION soon."—John Riley, Box 55, Bristow, Okla.

(This is the purpose of the "Practical Lessons" series that are now running in P. A.—J. B. R.).

* * *

"As you know, I subscribe to P. A. and have for quite a while. Well . . . in the October, '33, issue on page 221, is a picture of an army training plane and on page 222 is the new General shipboard fighter. They are printed back-to-back.

"Now that is very sad for a collector of pictures who classifies his pictures or indexes them according to some scheme. In making up the mag, don't you think that it would be a good rule to have all airplane pictures on even numbered pages like this—22, 24, 26, 28, etc.

"I don't mean to have all pictures on even numbered pages. Pictures of airplane radios, pilots, etc., could be on the odd numbered pages, just so long as pictures of airplanes would not come back-to-back. Or, if the pictures could be placed at the top of one page and at the bottom of the succeeding page, it would be O. K."—A. A. Askew, Jr., Box 72, Barrytown, N. Y.

(This would certainly complicate the job of makeup because all of the stories are not of the same length—but we can try it.—J. B. R.)

The 30th Anniversary of the Airplane

A flight in an early Wright biplane—the Model A. Note the front or "canard" elevators and the landing skids.

ON December 17, 1903, Orville Wright made the first flights in a powered airplane recorded in history. The first flight lasted only 12 seconds, the second and third flights were a little longer, while the fourth flight on this memorable day lasted 59 seconds and covered a distance of 853 feet against a 20 m.p.h. wind.

Just after the termination of the fourth flight, a gust of wind caught the plane, turned it over and so seriously damaged it that further experiments with it were impossible. But this old ship had served its purpose well because it was the first heavier-than-air machine in the world to raise itself from the ground under its own power and sail through the air in free flight. Its flight was only measureable in feet and its altitude was low—but it flew.

During that winter, a second ship was built—heavier and stronger than the first—but similar in most respects to the first plane. Then followed a period of engine trouble, beginning with the trial flights in the spring of 1904. This delayed progress, but after some little time, the Wright Brothers were making flights of several minutes duration. They had not been flying long before they found that the problem of stability had not been solved and that the ship would side-slip alarmingly in making turns.

The difficulty of maintaining the ship in equilibrium was not solved until the end of September, 1905, and from this time on, the flights rapidly increased in length. Experiments at Kill Devil Hill, N. C., were discontinued on October 5, 1905.

During this period the plane took off and landed on runners or skids, and wheels were not added for some time afterwards. It was brought up to take-off speed by catapulting it over a short length of track by means of a falling weight connected to the machine by ropes. In principle, this is the equivalent of starting a glider by means of the shock-absorber cord.

Twin propellers, chain driven and revolving in opposite directions, were driven by a small four-cylinder water-cooled engine. To maintain lateral balance, the wing tips were "warped" or twisted instead of using ailerons, and as will be seen, the biplane elevators were placed in front of the ship canard style. The elevators were later placed at the rear in the Model B.

Orville Wright, a photo taken shortly after the first flights.

P. A. Starts Its Note-Book Leaves

ON the opposite page, you will find the answer to a request made by our readers, a request that amounted almost to a demand in many cases. In short, this is the first installment of P. A.'s long discussed note-book consisting of four note-book pages.

All sorts of subjects, pertaining to aviation, will be covered by this series of data sheets. The sheets will provide our readers with a fund of information that would be difficult to publish in any other way, and best of all, this information is indexed in such form that the data is quickly available for reference. The contents will cover a wide range, running from shop notes of a practical nature, tabulations of materials and so forth, to technical notes for designers and builders.

Four of these sheets will be run each month, as on the opposite page, with the subjects varied so as to cover as great a range as possible in a short time. The Glossary of Words, Terms and Phrases, which is a mighty useful dictionary of aviation, will run intermittently until completed. This glossary alone is an exceedingly valuable reference.

Now, the reference numbers at the bottom of the sheets form the method of indexing the sheets, and sheets bearing similar symbols should be kept together. Thus, all sheets of the dictionary begin with the letters "DIC," the shop recipes and formulas by REC, and so forth. The second letter indicates a subdivision of the main subject, thus all sheets on the subject of airplane dope will be found under shop recipes (REC) and also under the subhead "D" which is the second letter. The third figure "1" is the numerical index of the sheet under any given subhead.

Therefore, the symbol;—REC-D-1, means that this sheet is the first sheet on the subject of airplane dope in the chapter dealing with shop recipes. This makes it easy to arrange your sheets in the proper order. There are a great number of symbols, of course, covering the field of aviation, but their origin or reason need not trouble you. All you have to do is, to keep sheets together that bear the same symbol.

Many of the sheets will contain handy tables, graphs and diagrams that will illustrate the text. Tables of steel tubing, standard connections, tubing, fittings and similar useful material specifications will also be included so that our readers will always be provided with acucrate dope on airplanes.

And now just a private word for your ear. We hope that our readers will contribute any data that they may have at hand and which they believe would be useful to other readers. Let us hear from you, as to what you think of the data sheet idea and all about it.

XUM

AIRPLANE DOPE — REC-D-1

A DOPE for the fabric of lightplanes, model airplane coverings or for waterproofing fabric covered hulls, can be made according to the following formula which is contributed by Roland Bramlet, Wallowa, Oregon.

DOPE FORMULA

Celluloid	1 Avoir. oz.
Acetone	2 fluid oz.
Castor oil	1/32 fluid oz.
Denatured alcohol	2 fluid oz.
Oil soluble colors	Optional

ROUTINE. (1) Dissolve celluloid in acetone. (2) Add alcohol. (3) Add castor oil. (4) Add dye or stain. Keep away from open flame, preferably out of doors as the vapors of the fluids are inflammable. Any amount can be made if the above proportions are maintained.

For waterproofing, the dope should be made thicker than above by adding more celluloid. If very thin dope for model fabrics is required, it can be thinned out by the addition of more acetone.

This dope will shrink paper and fabric to which it is applied, making it drum-head tight. Therefore, do not place fabric or paper under very high initial tension by stretching as the shrinkage may tear the fabric. From three to seven coats of the thin dope will be required for satisfactorily doping airplane fabric.

PERFORMANCE — PER-P-1

THRUST (DRAG) — HORSEPOWER

IN NORMAL horizontal flight, the horsepower (H) required for propelling a plane depends upon the propeller thrust (T) in pounds (or the drag D) and the velocity (V) in miles per hour. The engine power (H′) required is obtained by dividing the gross horsepower by the propeller efficiency (E). Thus:

$$H = \frac{T \times V}{375}, \text{ or the net engine power } H' = \frac{T \times V}{375 \times E}$$

The propeller thrust (T) is equal and opposite to the total drag (D) or resistance of the whole plane in pounds.

Thrust (Drag) Lbs.	Horsepower From Thrust (Drag) and Speed 50 M.P.H.	100 M.P.H.	150 M.P.H.	200 M.P.H.
1	0.13	0.26	0.39	0.53
5	0.66	1.33	1.99	2.66
10	1.33	2.66	3.99	5.33
20	2.66	5.33	7.99	10.66
30	3.99	7.99	11.99	15.99
40	5.33	10.66	15.99	21.33
50	6.66	13.33	19.99	26.66
60	7.99	15.99	23.99	31.99
70	9.33	18.66	27.99	37.33
80	10.66	21.33	31.99	42.66
90	11.99	23.99	35.99	47.99
100	13.33	26.66	39.99	53.33
150	19 99	39.99	59.99	79.99
200	26.66	53.33	79.99	106.66
300	39.99	79.99	119.99	159.99
400	53.33	106.66	159.99	213.33

To find the actual engine power, divide the above figures by the propeller efficiency which will range from 0.70 to 0.85.

GLOSSARY OF WORDS, TERMS AND PHRASES — DIC-A-1

A-Axis. The vertical centerline of a shaft or the vertical lines (axis) of a graph.

Abrasive. A hard sharp grained substance such as sand, emery, carborundum, etc., used for grinding or which causes grinding.

Abscissa. The quantities laid off along the horizontal lines of a graph, usually from left to right. Plural—Abscissae.

Absolute. Quantities measured from the zero point or origin. Thus, absolute temperature is the temperature measured from the point where heat is "zero" or ceases to exist.

Absolute Angle of Attack. The angle made by a wing, measured from the position of zero lift.

Absolute Ceiling. The altitude at which the airplane can climb no further, or where the rate of climb is zero.

Absolute Coefficient. The coefficients (C) originated by the National Advisory Committee on Aeronautics (N. A. C. A.) which are based upon the fundamental units of length, weight and time.

Absolute Horizontal. The position of the surface of a liquid at rest, such as the horizon indicated by a body of water.

Absolute Pressure. Pressure measured above a vacuum. At sealevel, under normal conditions, the absolute pressure of the atmosphere is 14.7 pounds per square inch, hence the absolute pressure is obtained by adding 14.7 to the pressure indicated by a gauge.

Absolute Temperature. Temperature measured from the point where heat ceases to exist. This is 461° F. below the zero on the Fahrenheit thermometer, or 273° C. below the centigrade zero. Thus, 461 is added to the readings of a Fahrenheit scale and 273 to the readings of a centigrade thermometer to obtain the absolute temperature.

Absolute Vertical. A radial line passing through the center of the earth as shown by a plumb-bob line. It is perpendicular to the horizon.

Absolute Viscosity. The resistance offered by a fluid to flowing. It is the force in dynes required to shear through a square centimeter of the substance in one second.

GLOSSARY OF WORDS, TERMS AND PHRASES — DIC-A-2

Accelerate. To increase the rate of motion, or to increase the speed of an object. Decreasing the rate of velocity is called de-acceleration or negative acceleration.

Acceleration of Gravity. The earth's attraction for an object causes a continual increase in the velocity of a falling body at the rate of 32.16 feet per second in the northern area of the United States. This acceleration is abbreviated by "g."

Accelerator. The lever connected with the throttle of a gasoline engine carbureter which controls the speed.

Acentric. Off the center. More particularly applies to the condition where the center of resistance is off the center line of thrust, or where the load is off the centerline of a column or strut.

Acetylene. A hydrocarbon gas having a rank garlic odor. It contains more heat per cubic foot than any other gas, hence it is extensively used in welding.

Acetyl-Gasoline. Gasoline impregnated with acetylene gas for increasing its heat and power capacity.

Acid Battery. A storage battery employing a sulphuric acid solution for an electrolyte.

Acrobatics. Trick flying. (Also Aerobatics).

Actinic Light. Light rays that are capable of affecting a camera film or of causing chemical changes to take place.

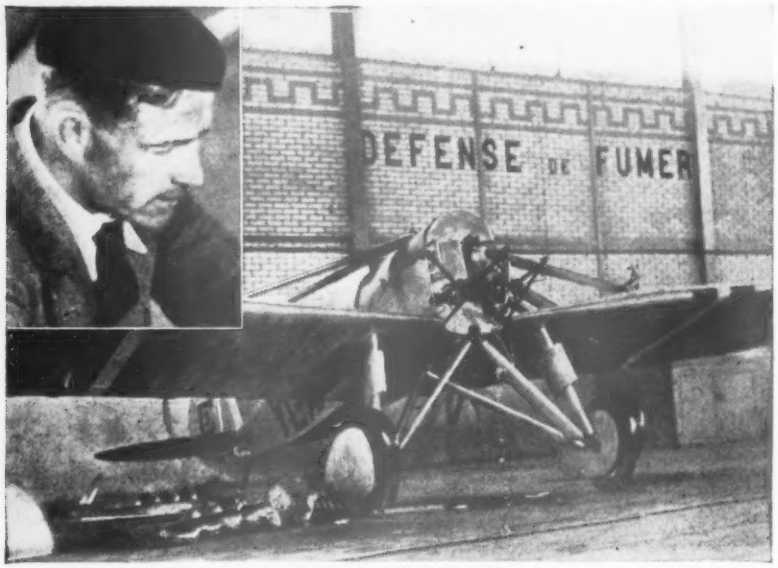
Adiabatic Compression. The compression of a gas accomplished so that heat cannot leave nor enter the cylinder.

Adiabatic Expansion. The expansion of a gas in a cylinder, so insulated that heat can neither leave nor enter the cylinder.

Adjustable Pitch Propeller. A propeller arranged so that the angle of the blades can be changed when propeller is not moving, but not when the propeller is turning. A semi-permanent adjustment.

Adjustable Stabilizers. A stabilizer so arranged that its angle of incidence can be changed either when on the ground or in flight.

Homemade Plane Will Attempt Long Flight



Here is the homebuilt long-distance plane with its builder, Herbert Cukans in the insert.

HERBERT CUKANS, an officer in in the Latvian Army Reserve, has built his own plane with which he intends to fly to Africa in the near future. He expects to make the Dark Continent in seven or eight hops.

This home-built outfit is powered with an ancient French engine—a rotary cylinder LeRhone to be exact—which he picked up second-hand at the "Flea Market" in Riga. This engine was taken from a plane that was shot down during the war, but it gives the aerial flivver a speed of 120 m.p.h. Flight tests have shown it capable of a ceiling above 20,000 feet.

To nip a lot of questions in the bud, the notice "Defense de Fumer" mounted at the top of the hangar, is the French equivalent of "No smoking allowed."

The Latest in Mobile Mooring Masts

A NEW type mobile mooring mast for small semi-rigid airships is now being used whenever the ships are away from permanent mooring facilities. The new mast, utilizing the principles of the larger tractor masts used with the Los Angeles and Graf Zeppelin, replaces the old type peg mast that required six guy wires and took a much longer time to erect.

The mast is built on a truck chassis weighing approximately 6,000 pounds with full equipment. The body of the truck may contain bus seats for transportation of the ground crew or it may carry extra equipment. The equipment truck carries a small radio transmitter and receiver, extra bags of sand ballast, parts and tools for repairs and baggage. Extra propellers are carried on each side in a recess above the running board while there is a built-in bunk where members of the crew may rest whenever they must remain at the field.

Outriggers prevent the truck from being overturned by cross-winds while balloon-tired wheels make it possible for the truck to be driven under its own power to tow the ship around. The brakes of the truck may be used to help hold the ship against the force of the wind. Four cables, fastened directly to the chassis, brace the mast and prevent any strain from being exerted on the body.

The Mobile mooring mast.

Only eight bolts are used in the assembly, making it possible to erect or dismantle the mast in fifteen minutes.

Cold Weather Hints for Amateurs

HERE are a few hints and rules which will greatly help the novice flyer when flying in cold weather or over water:

1. When taxiing downwind keep the stick well forward.

2. Get as much altitude as possible even for a short flight.

3. Never try stunts to amaze the onlookers. Remember that your ship isn't a Hell Diver.

4. Should a machine have a leaky float always make your turns away from it when taxiing.

5. After taking off the water in cold weather, move all controls slightly to prevent freezing water splashed on the controls or hinges.

6. When using sand beaches with water aircraft, always wipe controls clean with rag after greasing. This prevents sand from collecting and reduces wear on controls.

7. When landing on lake and doubtful of ice conditions, it is generally found that the thickest ice is in the middle.

8. When landing on glassy water, glare ice, or unmarked snow and when it is impossible to land near a shore line or building, throw out a dark object and land beside it.

9. Care should be taken not to underestimate the run on glare ice.

10. If operating off glare ice, a sharpened knife-edge tail-skid will be found a great help in taxiing.

11. Brass lined skiis will be found to be very satisfactory, particularly in soft snow.

12. Wet slushy snow is similar to mud; therefore, always land under this condition with the tail well down.

13. Always block skiis up over night and off the ice, or place a mat of evergreens under the skiis.

14. Cover the Pitot tube after landing to prevent condensation of moisture and blocking the air speed indicator.

15. If snow is sticky, oil the skis before taking off.

Where a light fall of snow has fallen over a crust, sweep runaway or taxi over it several times before loading or taking passengers.

16. Strips of newspaper under skis are sometimes helpful in taking off after a light fall of snow.

17. During winter flying always drain oil into clean can immediately after landing and store oil in a warm place.

18. During winter flying it is a good plan to remove spark plugs after landing due to condensation on the points. This prevents ignition missing due to condensation on the points. The spark plug ports should be filled with wooden plugs carried for the purpose.

19. Always preheat oil before refilling engine. The best means of preheating oil is to place the can in boiling water and stir the oil.

XUM

How to Build Anti-Drag Rings

by TIREY K. VICKERS

Here are full instructions for building an anti-drag ring for your lightplane. You will find that it is a mighty useful addition for it will have a marked effect upon the performance of your ship.

THE ONE great disadvantage of the radial air-cooled engine—its high air resistance per horsepower—has been practically eliminated by the use of the N. A. C. A. cowling, which fits around the outside circumference of the engine.

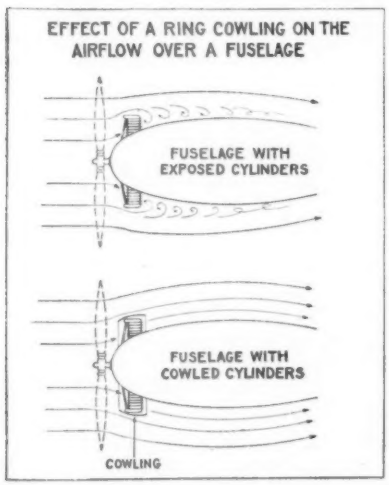
The main idea of this type of cowling is to keep a smooth flow of air over the fuselage and at the same time, provide an adequate flow of air around the cylinders. The result is an appreciable decrease in the drag of the airplane. A simplified theory of the action of this type of cowling is as follows:

When no cowling is used on the engine, the projecting cylinders cause the airflow to break away from the surface of the fuselage and form large eddies, producing a high drag. When a cowling is installed, however, the airflow is smoothed out, and the air is made to follow the contour of the fuselage.

There have been many modifications of the N. A. C. A. cowling, but perhaps the most interesting is the Townend ring or anti-drag ring cowling. Although it is not as efficient in reducing drag as the wide N. A. C. A. cowling, it is nevertheless helpful, and has several advantages all its own.

As it is only a narrow ring, it is lighter in weight and less expensive than the N. A. C. A. cowling. It obstructs the pilot's vision less and can be quickly removed for servicing the engine.

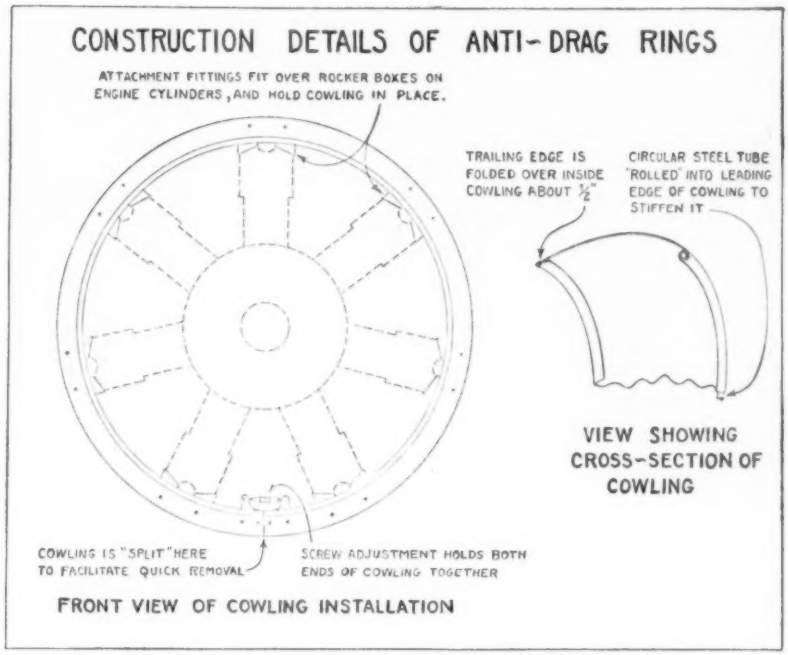
The anti-drag ring rarely increases the cruising speed of an airplane, if the original speed (without cowling) is less than 120 miles-per-hour. However, by smoothing out the airflow along the fuselage, it greatly improves the sensitivity of the tail-group controls. On many low-powered ships, the cowling is installed mainly for this purpose. Like the N. A. C. A. cowling, the anti-drag ring adds to the appearance of any plane when finished in colors harmonizing with the rest of the ship.


EFFECT OF A RING COWLING ON THE AIRFLOW OVER A FUSELAGE
FUSELAGE WITH EXPOSED CYLINDERS
FUSELAGE WITH COWLED CYLINDERS
COWLING

If the original cruising speed of the airplane is greater than 120 m.p.h., the installation of a Townend ring will usually increase the speed noticeably, sometimes as much as 10 per cent. On planes with broad, flat-sided fuselages (such as a Bellanca, for instance) an anti-drag ring seems to give better results than a full N. A. C. A. cowling.

If correctly designed, a Townend ring installation will not hinder proper cooling of the engine; to the contrary, it will usually increase cooling efficiencies. On some planes, however, a large "bulge" in the contour of the fuselage, immediately behind the engine, will obstruct the flow of air through the cowling, causing the engine to overheat. For this reason, cowlings are seldom installed on the center engines of trimotored ships.

Practically all anti-drag rings are made out of sheet aluminum. Some are "spun" to shape on a machine resembling a large lathe, but most of them are "bumped" out with a power hammer. A circular piece of tubing is rolled into the leading edge of the cowling, and serves to stiffen it. The trailing edge is folded back inside itself (for about one-half inch all around) so as not to leave a raw, sharp edge.


CONSTRUCTION DETAILS OF ANTI-DRAG RINGS
ATTACHMENT FITTINGS FIT OVER ROCKER BOXES ON ENGINE CYLINDERS, AND HOLD COWLING IN PLACE.
TRAILING EDGE IS FOLDED OVER INSIDE COWLING ABOUT ½"
CIRCULAR STEEL TUBE "ROLLED" INTO LEADING EDGE OF COWLING TO STIFFEN IT
VIEW SHOWING CROSS-SECTION OF COWLING
COWLING IS "SPLIT" HERE TO FACILITATE QUICK REMOVAL
SCREW ADJUSTMENT HOLDS BOTH ENDS OF COWLING TOGETHER
FRONT VIEW OF COWLING INSTALLATION

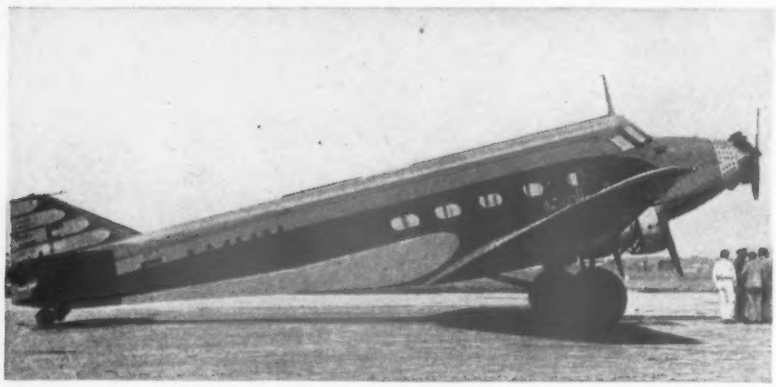
The Townend ring is fastened to the engine with small fittings or brackets, which serve mainly to keep it from slipping forward or backward. These fittings are riveted on the inside of the cowling, and are usually padded with felt to avoid metal-to-metal contact between the cowling and the engine.

Most ring cowlings are made in one piece but are "split" at the bottom to facilitate easy removal. A screw adjustment, resembling a turnbuckle, bridges the gap. When this adjustment is tightened, the two ends of the cowling are drawn together and the cowling clamps down tight around the engine.

If tightened too much, a cowling will set up an alarming vibration in flight, somewhat analogous to wing flutter. On the other hand, if the cowling is too loose, it will rattle badly in the slipstream and may eventually pull loose from its brackets. If an anti-drag ring ever comes loose during flight, it will blow *forward* into the whirling propeller blades, instead of backwards, as one might expect. In a mishap of this kind, the cowling will be badly "chewed up" before the engine can be shut off, and the propeller may be damaged beyond repair. I cite this merely as a precaution.

END.

The Wibault-Penhoet French Tri-Motor



A side elevation of the Wibault-Penhoet tri-motor transport plane now used on French air lines.

FRANCE, unlike the United States, is still pinning her faith to the tri-motor as the leading design for transport. Here we have a late Wibault-Penhoet passenger ship that is of interest and which represents the last word in French development.

Like many European transport monoplanes, particularly of the low-wing type, they have given the lower wing a heavy dihedral angle. The lines of the fuselage have been laid out, apparently, with the view of utility first and streamlining as a secondary consideration. It is not likely that the speed is very high with this ship, and in such a case, roominess and structural considerations are of more importance than a slight difference in the fuel consumption, even though the price of gasoline in France is much higher than in the U. S. A.

Chinese Patriots Study Aviation

THE Chinese have always been interested in aviation, from the very beginning, and it would be difficult to find an aviation school in the United States that did not have one or more Chinese students enrolled at some time or other.

But now matters are different. Chinese students are still enrolled but not simply from an interest in airplanes. They are now enrolling in the most part with a view of enlisting in the Chinese Air Corps where possibly many of them will engage in active service.

The picture below shows a class of Chinese patriots recently graduated from a California school. These twenty students have been financed by a Chinese patriotic society with the understanding that they will enlist in the Chinese service on call. This fits in very nicely with the fact that many American military planes are being ordered by the Chinese Government and that there will be American trained Chinese to fly them.

The class of Chinese flying students recently graduated from a California flying school.

The Same Old Stuff — Same Old Stuff

SAM the Super Salesman was in to see us the other day. He had on a long face and was in generally depressed spirits. We advised him to have a good cry and he did so, after which he told us his tale of woe. It seemed that he'd called on a prospect in the hope of selling him a new plane which his (Sam's) company was putting out with high hopes.

For two hours steady he poured into the poor victim's ear the story of how fast, how safe, how economical and how completely superior to all other ships this plane was. By then the prospect's resistance was completely beaten down and with quivering hand he pulled out a checkbook, intending to write a check then and there.

Everything was rosy until he asked Sam if the plane could be delivered the next day. When Sam told him that this particular ship had been designed only a week ago and none had been built as yet the prospect got peeved for some reason or other and the deal was off.

No Chutes in Bolivia

THE parachute is not included in the equipment of members of the Bolivian Air Force. The reason is that no chutes have yet been found satisfactory because of the rarified air in the high altitudes of the landing fields and the country as a whole. La Paz, the capital, is 13,000 feet above sea level and many good landing fields are above 12,000 feet. Landing speeds are high and takeoff runs are long. Experiments with increased wing area for planes are being tried.

All Sorts of Materials in the "Macon"

THE modern dirigible is a complex "animal." For instance, more than a dozen kinds of metals were used in the construction of the Navy airship "Macon."

Aluminum and its alloys, of course, are the chief components of the huge frame. But alloy steels in nickel, chrome, molybdenum and several other grades also have been employed. Outrigger fittings have been made of nickel steel for strength. Exhaust manifolds are of stainless steel, while non-magnetic steel is used around the control boards where other metals would magnetize.

Various fittings and parts are of plain carbon steel, and some iron is used, mostly as rivets, although all of the 9,850,000 rivets in the ship framework proper are of duralumin. Some parts and fittings are of magnesium and others are of monel metal. Fuel lines near the engines are of bronze, and some of these lines are of copper. Some of the delicate navigation instruments contain platinum.

XUM

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

Test-Hopping Your Plane

SCORES of lightplane constructors have test-hopped their own planes after completion, and successfully, too. Many have made their first flight on a test-hop, and have learned to fly by themselves without instruction, but we do not believe that this is a logical thing to do at the present time.

There are plenty of experienced pilots available all over the United States, and there are many of these pilots making test-hops a specialty, so why risk your hard earned money and hours of hard work by attempting the testing of the new plane by yourself? This is very poor economy, we'd say.

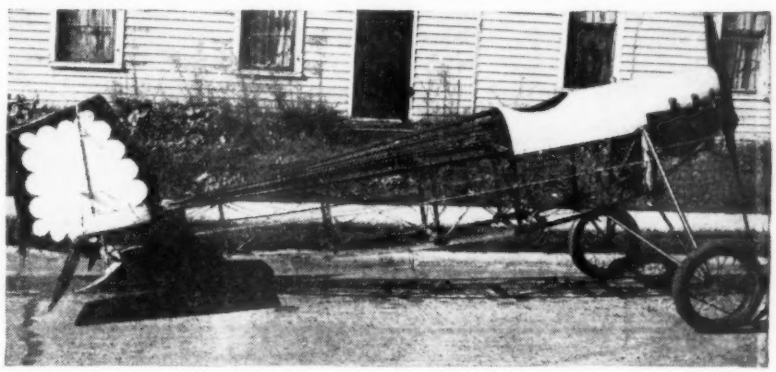
In the first place, an experienced test pilot knows how the ship should fly, and his experience tells him just what alterations must be made before the ship flies according to Hoyle. It may seem to be all O. K. according to your inexperienced senses, but to the pilot it may be decidedly all wet and he can tell you just where the trouble lies so that a better performance can be expected than would be the case without his advice.

Some pilots will make the test-hop for nothing—just for the fun of the thing—while others will ask for compensation, usually a very moderate fee for an amateur. But no matter whether you get this service free or have to pay for it, you will find that an expert's opinion is a mighty good thing to have around your plane. This is of particular value in case the ship should show a marked tendency toward spinning or stalling, in which case, the amateur would hardly be the master of the situation.

Even with a ship built from a standard kit-set and with the builder holding a private license, we still maintain that the builder should avail himself of council. It may fly, granted, but it still may be made capable of better performance. By making a few minor changes, the speed may be increased, the landing speed decreased or the rate of climb may be improved. The engine may need tuning up, the propeller may not be suitable for the job at hand or the right or left wing may be "heavy."

All of these factors must be taken into consideration and if wrong, must be rectified at once. If big airplane manufacturers find it advisable to get expert criticisms on their new jobs, it seems that this would be even more necessary for the basement and barn builders.

This Indiana Plane is Built Well



The fuselage, etc., of the Saine-Daistine lightplane of Peru, Ind., which is said to be unusually well built.

MELVIN SAINE and Harold Daistine, Peru, Ind., have built a ship that is somewhat different from the average home-built plane. According to Ed Nelson, who viewed the job, it is exceedingly well built with great care taken of every structural detail.

It is powered with a Star-4 engine which turns a 5 foot 10 inch diameter, 42 inch pitch propeller at 2,000 r.p.m. on the ground. The span of the top wing is 24 feet 0 inches with a 20 foot 0 inch lower wing. The engine will be cowled so that any part can be repaired without removing all of the cowling.

The builder say that it will look something like a cross between a Jenny and a Curtiss Hawk when in the air. We have tried to visualize a bird like this but have failed.

The only part on the ship, not made by themselves, is the tail-group—three guesses as to what it is and where it was taken from! However, they have greatly strengthened this member by proper bracing, so that it is now equally as strong as the other members of the ship. Ed Nelson says, that the landing gear will take all that they can give it, and when this comes from Ed it means something for landing gears are Ed's pet peeves.

Allen Builds A Russell-Henderson

R. K. ALLEN, Berthaville, Va., sends in a snapshot of the Russell-Henderson plane that he is building. The wing span is 25 feet, chord is 50 inches and it is 15 feet long.

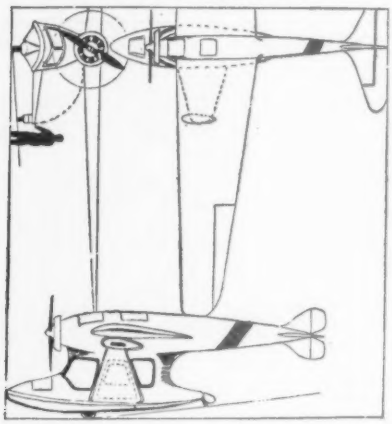
Mr. Allen has been working on this job for 18 months and he is looking for the guy who says the job can be finished in three months. Our friend is to be congratulated for the fine appearance of this little monoplane and trust its performance will equal its looks.

R. K. Allen spent plenty of time and work on this fine looking job, but it was time well spent to judge from the picture.

Dream Ships by Our Dreamers

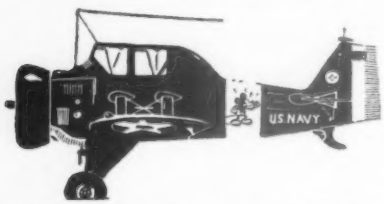
Here we have an open forum for the ideas of our readers who have been bitten by the designing bug. All are interesting, some are good, some are fair and some are—

The Flying Shoe



PAUL LAWRENCE shows us his ideal of an all-metal amphibian fighter of neat design. It has a span of 60 feet and shows good visibility and clean lines.

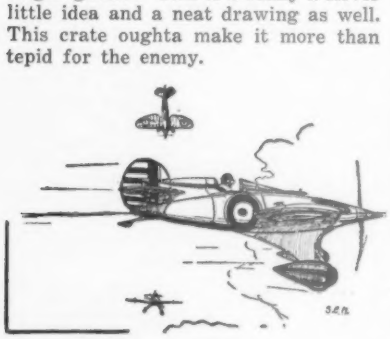
The Mickey Mouse Fighter



THIS entrant did not sign his name, but shows a neat sport coupe for the U. S. Navy to fly around in. Just why the Mickey Mouse insignia, we do not know. It is complete even to windshield wipers.

The Monroe Dog-Fighter

SAMUEL C. MONROE, New York City, sends us a drawing of a hot looking speed-scout which he calls "The Dog-Fighter." This is a really a clever little idea and a neat drawing as well. This crate oughta make it more than tepid for the enemy.



A Pusher Type Tries Dog-Fighting

ARCH J. KINZEL has submitted a very original design together with a neat artistic action picture that shows up the details of the ship in fine shape.

In the first place, a pusher always interests us, and secondly, when this pusher is provided with duplex propellers (like the Italian Red Bullet), the interest is more than doubled. Yes sir, the double prop pusher is making it plenty hot for the Gull winged job up in the corner.

The tail group is carried by two outriggers similar to those of the Vance ship which makes a very neat job, and the duplex propellers, revolving in opposite directions, eliminates the torque. The pilot has a full field of vision and an excellent field of fire, at the same time being in a protected zone where a little armor would make it difficult to get him.

Notice!

OUR dreamers have been hard at work, pounding the pillows and at the same time—pounding out new ideas.

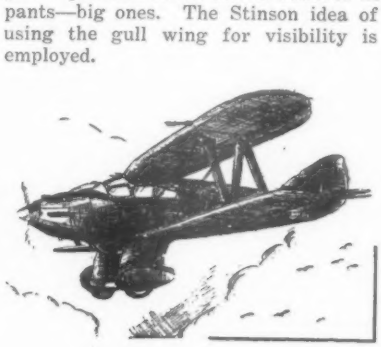
We have had a deluge of dreamships submitted many of which will be published, so just have patience until your dream appears. We can only publish four or five ships per issue so it takes a certain amount of time to get around to your contribution.

Now, we have a particular type of ship that we would like to have you get busy with. This is a pursuit ship of the same general type as that shown in the lower left-hand corner of this page. It is to be a prestone cooled ship, either a monoplane, biplane or triplane, and must be compact.

A Fine Cabin Job

MURRY DUNNE has favored us with a biplane cabin ship of neat appearance and a novel window arrangement that should be productive of a good visual range to the occupants.

He has forsaken the radial type engine and has gone into liquid-cooled power-plants. He is also a believer in pants—big ones. The Stinson idea of using the gull wing for visibility is employed.



A New Portable Ice Yacht

ICE-BOATING enthusiasts will be interested in a portable ice yacht now on the market in knockdown kit form. One who has enjoyed the grand thrill of flashing across the smooth ice, will readily appreciate what this portable feature means.

According to Mead Gliders, manufacturers of the new Batwing Ice-Yacht, this new portable feature will place the sport of ice-yachting within the reach of anyone living from one to one-hundred miles from sailing ice. This ship can be assembled at home in a few days, then quickly dismantled and transported anywhere right on the running-board of an auto. Re-assembly, ready for sailing, is a matter of five minutes at the most. Space for two passengers is provided.

Mead Batwings steer at the front instead of the rear. Hiking and skidding on turns has thus been virtually eliminated. In place of the conventional and awkward tiller, a convenient steering-wheel has been substituted. Greater riding comfort, due to the shock-absorbing runner-plank and correct distribution of weight, is also noteworthy. Another feature is a powerful exclusive emergency brake.

The new Batwing sail, which carries ninety square feet, is of the "shallow draft" type. It has been designed along the theory of racing airplane wings.

Batwing III knocks down in a minute for auto transportation. Sets up in from 3 to 5 minutes.

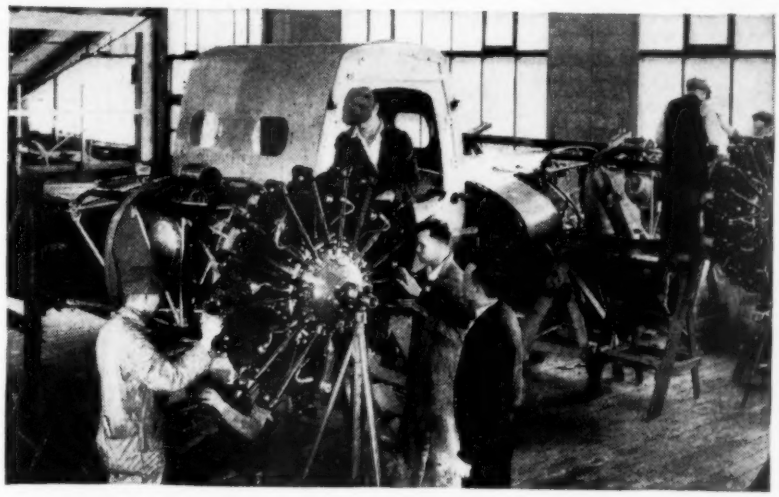
International Air Mail

MORE than 14,000 pounds of air mail passes through the international airport of Miami each month to and from the Latin American countries of the Caribbean district alone.

This means more than half a million of letters travelling through the air each month to speed the interchange of trade between the United States and the republics surrounding the Caribbean sea exclusive of Central and South America. During the first six months of 1933 business houses in the United States sent 25 tons of air mail, or more than two million letters, into the Caribbean district.

In return, business mail from the Carribbean countries has amounted to more than fifty per cent of that sent from the United States. These figures are a barometer as to the increasing interest in commerce between the United States and these countries which lie directly to the south of us.

Details of the Wasp Engine S1D1



Assembling the Wasp engines on the "247" planes at the Boeing plant, Seattle, Wash.

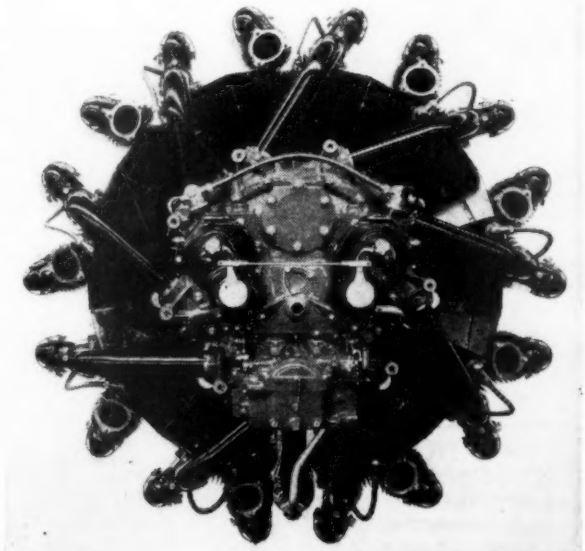
OF INTEREST to our model contest entrants is the Wasp engine used on the Boeing "247"—the engine that shoots the ship along at its three-mile-per-minute clip.

This specially "suped-up" Wasp engine is the type S1D1 which is rated at 525 h.p. turning over at 2,200 r.p.m. at sea-level, using a controllable pitch propeller. With a fixed pitch propeller, the output is reduced to 480 h.p. at a speed of 2,000 r.p.m. It direct drives a Hamilton Controllable pitch propeller on the Boeing "247" so that we can say that the twin engines develop a total of 1050 h.p. at sea-level.

It is a nine-cylinder radial air-cooled engine having a bore and stroke of 5¾ inch x 5¾ inch, or a total displacement of 1344 cubic inches. The compression ratio is 6:1 with a blower ratio of 10:1. At full throttle and rated speed, it consumes 0.55 pounds of gasoline for each horsepower-hour with gasoline having an octane rating of 80. This means that both engines consume 577.5 pounds of gasoline per hour under the most favorable conditions, or 96.2 gallons per hour, approximately.

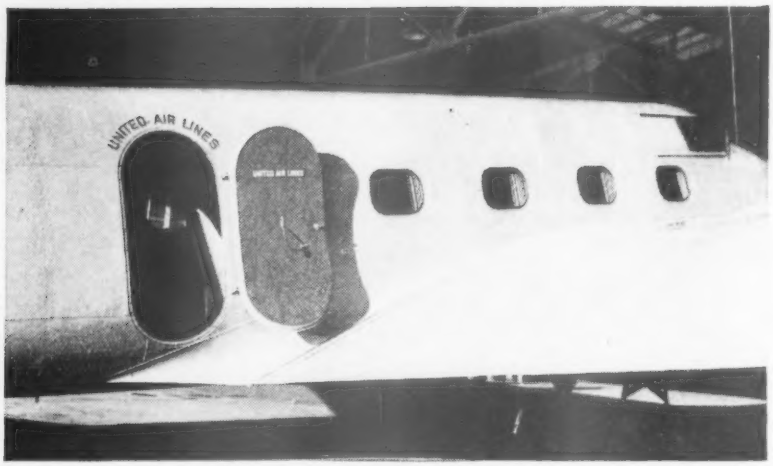
The overall outside diameter of the engine is 51⅞ inches while the overall length is 42⅞ inches. Complete, and with standard equipment, it weighs 735 pounds. The engine drives through gearing, the fuel pump, an electric generator, a vacuum pump, two magnetos and a tachometer or revolution meter. These accessories are placed in the engine nacelle. Scintilla magnetos are standard while the carbureter is a Stromberg NAY-8E.

The installation of the engine in front of the engine nacelles on the wing is such that the parts are made very accessible for adjustment and repair. The engine is started by a portable electric motor through a long rod that reaches to the upper part of the nacelle where a stub projects through the housing.



Rear view of the Pratt & Whitney "Wasp" engine, Type S1D1, showing the mounting of the auxiliaries.

Our Final Notice to



Side elevation of cabin showing the passenger door (right-nand side), the windows and the filleting of the wing.

Special Notes

AS THE time grows near for our contestants to submit the photographs of their models, we will give a few final instructions.

1. *Submit only one or more photos of your model. DO NOT SEND THE MODEL UNTIL WE ASK YOU TO SEND IT.*
2. *Be sure that your name and address are on the back of every photograph submitted.*
3. *The awards will be based (1) upon the excellence of the workmanship; (2) Upon the fidelity to the original full-size ship; (3) Upon the finish.*
4. *This contest closes December 26, and no photographs postmarked later than this date will be examined.*
5. *When we ask you to send your model be sure that it is well packed so that it will not be damaged and we advise you to insure it against loss or damage.*
6. *YOUR MODEL WILL BE RETURNED TO YOU.*

FOR the benefit of the contestants in our model building contest, the editors of POPULAR AVIATION made a special inspection trip to the Municipal Airport where there are twenty-eight of the Boeing "247's" in daily service.

These planes are unusually beautiful jobs. They are outstanding examples of fine workmanship and design, of far better appearance than any all-metal ships that we have seen. The metal covering of the wings and body is perfectly smooth, highly polished and without a suggestion of waves, dents or kinks—quite a remarkable job of sheet metal work. In color, they are a very light uniform gray, slightly darker than the natural color of aluminum, while the lettering is in black. There is no other color scheme nor decorations of any kind.

Looking at the tail-group, we see that it is a very substantial piece of work with heavy hinged fittings made of castings for both the rudder and the elevator. To permit of these heavy connections, there is a considerable air-gap between the fixed and hinged surfaces, probably about an inch at some points. All members of the tail-group are self-supporting without external braces and for this reason are very thick.

It should be noted particularly that both the rudder and elevator are provided with Flettner flaps, that is, small auxiliary flaps inserted into the main movable surfaces. The control wires run from the flaps to the pilot's compartment instead of running wires from the main surfaces. When the rudder or elevator are to be moved, the small flaps are adjusted by the pilot and the wind pressure on the flaps moves the large heavy main surfaces. This is not applied to the ailerons which are actuated in the usual manner.

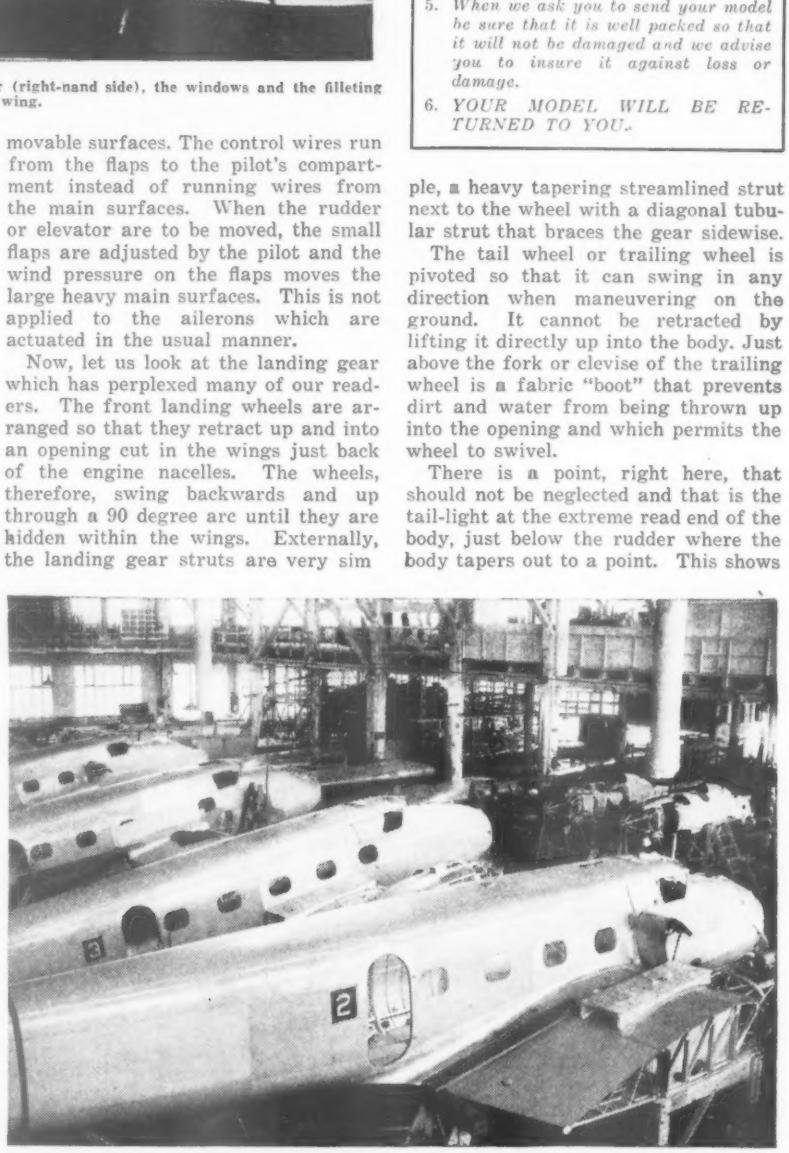
Now, let us look at the landing gear which has perplexed many of our readers. The front landing wheels are arranged so that they retract up and into an opening cut in the wings just back of the engine nacelles. The wheels, therefore, swing backwards and up through a 90 degree arc until they are hidden within the wings. Externally, the landing gear struts are very simple, a heavy tapering streamlined strut next to the wheel with a diagonal tubular strut that braces the gear sidewise.

The tail wheel or trailing wheel is pivoted so that it can swing in any direction when maneuvering on the ground. It cannot be retracted by lifting it directly up into the body. Just above the fork or clevise of the trailing wheel is a fabric "boot" that prevents dirt and water from being thrown up into the opening and which permits the wheel to swivel.

There is a point, right here, that should not be neglected and that is the tail-light at the extreme read end of the body, just below the rudder where the body tapers out to a point. This shows

NOTICE!

The time for entering your photographs has been extended to December 26, 1933. No photos will be received in letters bearing a postmark later than this date.

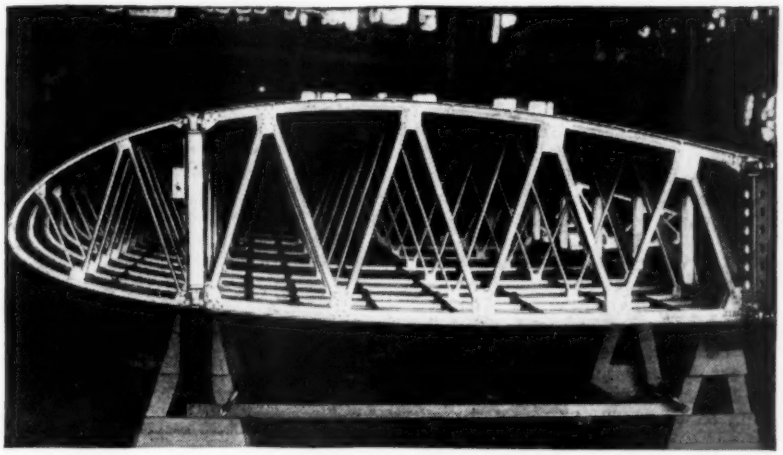


A group of "247's" undergoing construction in the Boeing shops, Seattle, Wash. The fuselage are in front while the engine assembly is across the aisle.

P. A. Model Contestants

Remember That —

1. *That there is absolutely no limits on age, experience or any other factor, except that the entrant must live in the United States, Canada or Mexico.*
2. *It makes no difference what material you use, metal, balsa wood, fiber, solid wood, cardboard or what have you?*
3. *You can build the model from the raw materials or from kits purchased from your dealer.*
4. *You can make your model as large or as small as you wish.*
5. *There is absolutely no entry fee nor any expense attached to the entry except that you pay for the materials, the photographs and the cost of shipment.*
6. *The model can be of the flying or non-flying type, it makes no difference as long as it is accurately to scale.*
7. *You can use as much detail as you wish, or as little. That is up to you. Accurate workmanship counts above everything.*



Detail of the all-metal wing structure of the Boeing "247." It is not necessary, of course, to enter into all of this work.

as a glass lens about 6-inches in diameter with the lamp and the reflector behind it.

The main wings spring from the lower part of the body and carry the engine nacelles at a point 7 feet 6 inches from the center of the body. They are self-supporting, without any external bracing, with the ailerons on the trailing edge as usual. Near the body, the under-surface of the wings is convex, but this tapers out toward the tips. To the rear of the engine nacelle is a rectangular opening into which the wheels retract when in flight.

Along the leading edge of the wings, just a little further toward the tips than the engine nacelles, are the openings cut for the large landing-lights. These openings are rectangular and are covered with transparent pyroxylin for the protection of the lamp and its reflector. On the inward edge of this landing-light opening is a sheet metal shield that projects beyond the leading edge. This shield prevents the glare of the landing-lights from annoying the pilot and is a recent addition not shown on the plans.

The interior of the wings is not of particular interest to the model builder as he will not be expected to reproduce this elaborate system of bracing, but the accompanying photo will indicate the thickness of the wing and the general outline of the wing section taken near the body stations.

As shown by the phantom view in the November issue, the body or fuselage carries cargo and mail both in the nose and also at the rear of the body. The ten passengers are seated in ten individual metal framed chairs with an aisle between the rows. The pilot and co-pilot are carried above the level of the passenger compartment and to the rear of the nose. This can be seen best from the phantom view referred to.

Mail, or other cargo, is placed in the forward part of the body by swinging the nose to the right on its hinges. The cargo space in the rear is entered through a door on the left of the body, just in front of the tail group. The passenger compartment is entered by a door at the right side. There is also a doorway between the pilot's cabin and the passenger cabin.

Just to the rear of the nose and projecting below it, is the tube for supplying air to the instruments. This projects downwardly for about 14-inches.

OF GREAT interest are the insignia placed on the tail group. On the vertical rudder is the license number, different for each ship in the fleet, with the name of the builder below it. The marking inscribed on the fixed vertical fin is more complicated for it indicates

Your name and address must be on the back of every photograph submitted in this contest. This coupon, or a facsimile of it, should be pasted on the back of each photograph

POPULAR AVIATION SECOND INTERNATIONAL MODEL AIRPLANE CONTEST
608 South Dearborn St., Chicago, Ill.

Please enter this photograph of my competing model in your contest. My entry is an accurate model of the Boeing "247."

☐ Flying model. ☐ Non-Flying model.

Name .....

Address .....

City..... State.....

A large scale drawing of the Boeing "247" suitable for tracing (scale 1/8" to the foot thus reducing the model span to 23 inches approximately). Simply fill out the coupon below and mail it to the address given.

POPULAR AVIATION, Box 210, 6-66
608 S. Dearborn St.,
Chicago, Ill.

Please send me the large scale plans of the Boeing "247" monoplane.

Name .....

Address .....

City..... State.....

the purpose and routing of the ship.

Above, on the fixed vertical fin, is the insignia or "trade-mark" of the builder —the name "BOEING" with wings at the top. Immediately below this is a line showing that this ship carries air-mail, while in the second line is the route number.

For example, if the second line should read "A.M.17" this means that this particular ship flies airmail on Route No. 17 which is the New York to Chicago run. All in all, there are five main runs which are enumerated as follows:

A.M. 3—Chicago to Dallas run.
A.M. 5—Portland to Salt Lake City run.
A.M. 8—Seattle to San Diego run.
A.M.17—New York to Chicago run.
A.M.18—Chicago to San Francisco run.

The bottom line, of course, shows that the ship also carries express. You will note that we show specimen insignia on page 402.

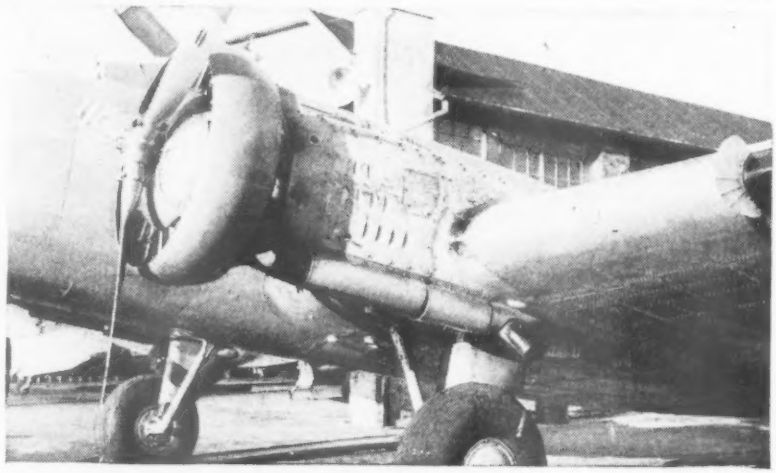
* * *

AND now for the answers to the many questions that we have received from our readers regarding this contest. These questions are of such a varied nature that they should cover nearly every point concerned with the building of the model.

Q. What is the color of the interior finish in the passengers' compartment?
A. Mottled dark green.
Q. Is the rear end of the anti-drag ring closed?
A. No. The air passes through the cylinder spaces and then around the nose of the engine nacelle.
Q. What is the hump on top of the engine nacelle?
A. This is the oil cooler.
Q. What kind of wheel is the trail-wheel?
A. An air-wheel.
Q. Is a round radio mast used?
A. No. It is streamlined.
Q. Is there any fabric on the wings?
A. No. All-metal covering is used.
Q. Where are the door hinges placed?
A. On the forward edge of the door.
Q. Are curtains provided at the windows?
A. Yes. Sash curtains arranged ver tically in two halves.
Q. Are the sides of the engine nacelles removable?
A. Yes.
Q. Are rigid or adjustable propellers used?
A. Controllable propellers.
Q. Is the glass curved in front of the pilot or "vee" shaped?
A. Vee shaped.
Q. Are de-icers installed?
A. Not on the present ships.
Q. Can the plane be flown with one engine?
A. Yes, and it can climb on one engine.
Q. Are there fillets between the wings and fuselage?
A. Yes.

(*Concluded on page* 402)

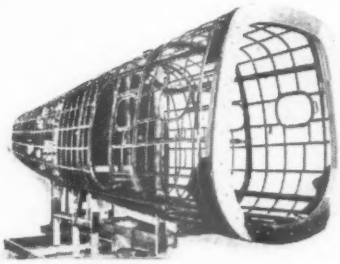
Interesting Views of the Boeing "247"



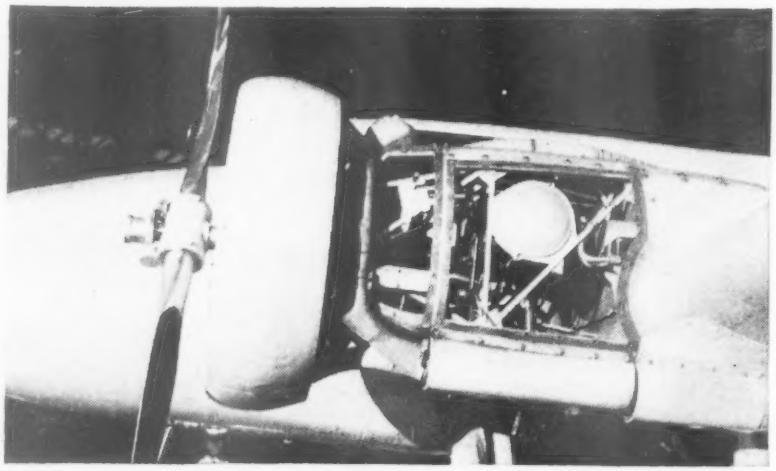
The engine nacelle, landing gear and propeller.

Rudder and Fin details.

The pilot's compartment.



Fuselage structure.



Interior of an engine nacelle with cover removed.

Building A Flying Autogiro

by

JACK KNOBLE

Professional model builder and designer.

A three-quarters view of the completed Autogiro showing the engine, landing gear details, pylon and wing construction. This is a model of which the builder can feel proud.

WELL fellows, I sure had a tough time making this job fly, and it didn't either, until I made exhaustive wind-tunnel tests and cracked up seven models in test flights.

Altogether, I spent two months experimenting, before I could claim success. It's a scale model, as close as possible, and has a 22 inch rotor span with an overall length of 13 inches.

I know you will have a lot of fun building it, as the plans are full size throughout. All you have to do is fold up the drawings, one to three, join them on your working board and start to work. Now let's get down to technical details.

FUSELAGE

LAY a thin sheet of wax paper over the drawings, so the cement will not stick to them, then take strips of 1/8 inch square balsa and make both sides of the fuselage, one on top of the other, so each side will be accurate. Hold the strips in place with straight pins. After the sides have entirely dried, cut them apart. Take the scraps of your 1/8 inch strip and measure off cross-pieces from the top view and cement them in place, making sure the fuselage is square before the cement sets.

Cement the wide cross-pieces in first, then gradually work back toward the tail. After this is finished, cut out the fuselage formers, shown on Plate 3, and cement them in place as shown on the side view. All these formers are cut from 1/32 inch sheet balsa except No. 1 which is cut from 1/8 inch stock. The black dots on the drawing are the notches for the stringers.

The stringers are now layed in the notches in the formers and cemented in place. The cockpits are formed with 1/8 inch diameter reed which is shaped over a candle flame. Also cement the rear motor hook in place.

Rear view of the model Autogiro showing the method of bracing the rotor blades and the assembly of the tail group and wings.

WING

AT THE upper part of plates (1) and (2) you will find the full size wing which is built in one piece. Cut the ribs (the pattern is on the side view), and lay 1/8 inch square balsa strips in their places on the drawing and cement the ribs in place.

To obtain the dihedral—break the three 1/8 inch strips of balsa, one inch away from the center line. Put plenty of cement in the cracks after raising each end of the wing 1/2 inch off the work board, and resting them on a 1/2 inch object.

Insert the wing in the fuselage as shown in the drawing. Cement a piece of 1/16 inch sq. balsa underneath the leading edge of the wing to give it a 1/16 inch positive incidence. Now cement the entire wing in place making sure it is centered properly as measured from center of fuselage and the wing tips.

TAIL SECTIONS

MAKE the tail sections as shown in the plans. The rudder may be made adjustable by cutting the two 1/16 inch sq. balsa pieces, that run next to each other where the rudder post is located, apart. But cut them apart after it has been papered. Insert short lengths of fine iron wire between the fin and rudder sections, and cement. These wires act as hinges.

The elevators are stationary and are cemented to the first longeron above the rear motor hook. Cement the tail sections to the fuselage later.

(*Continued on page* 399)

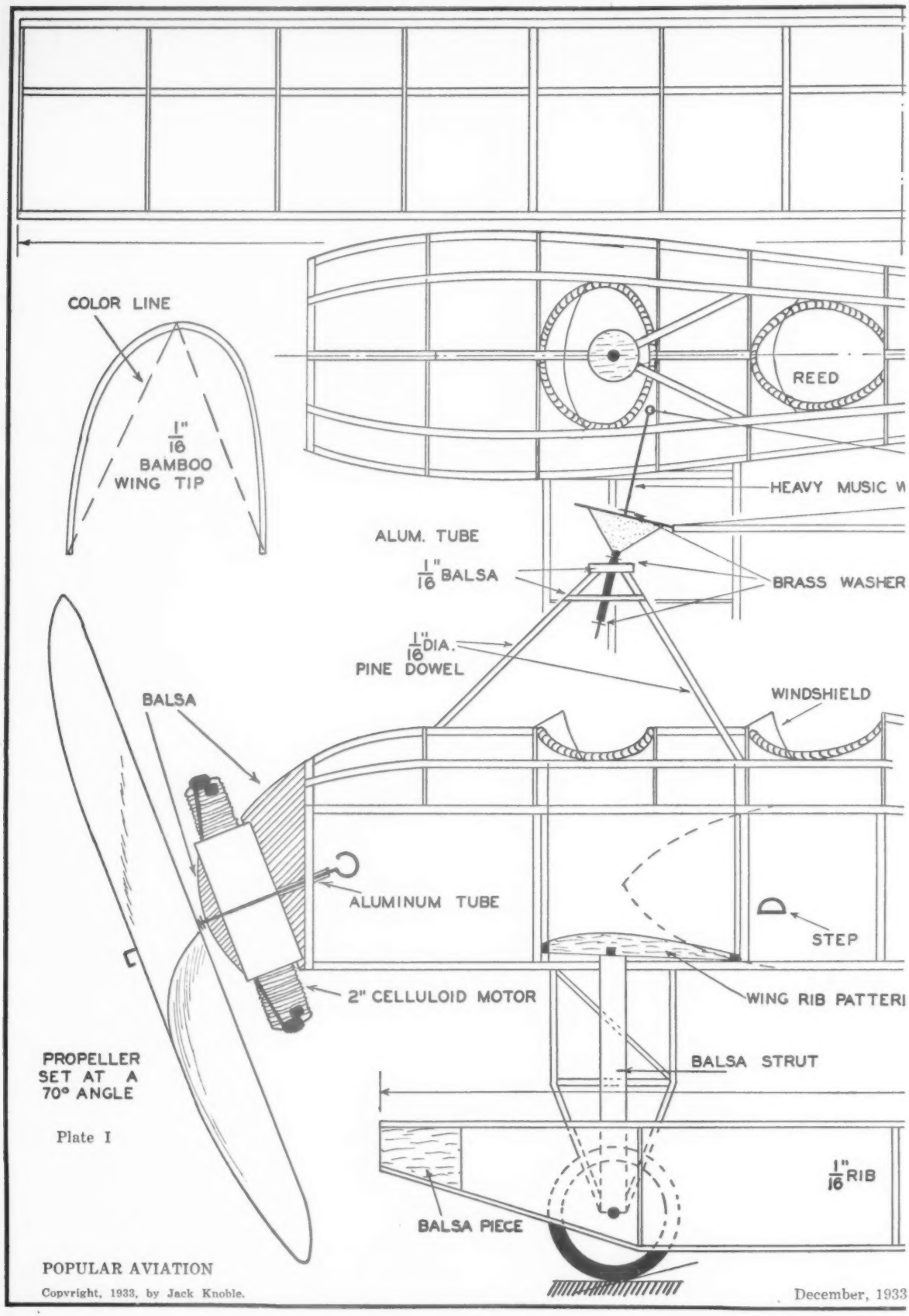
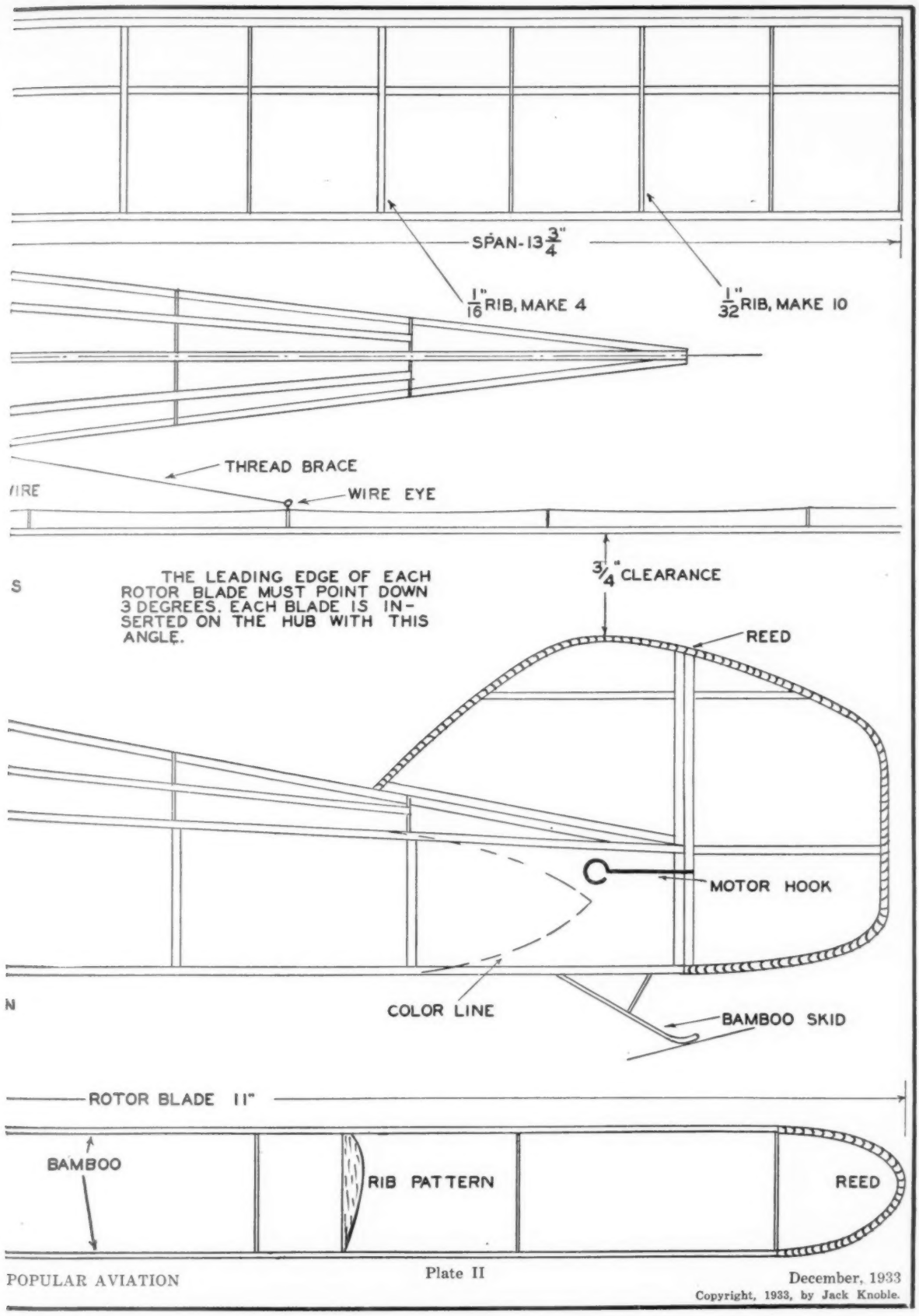


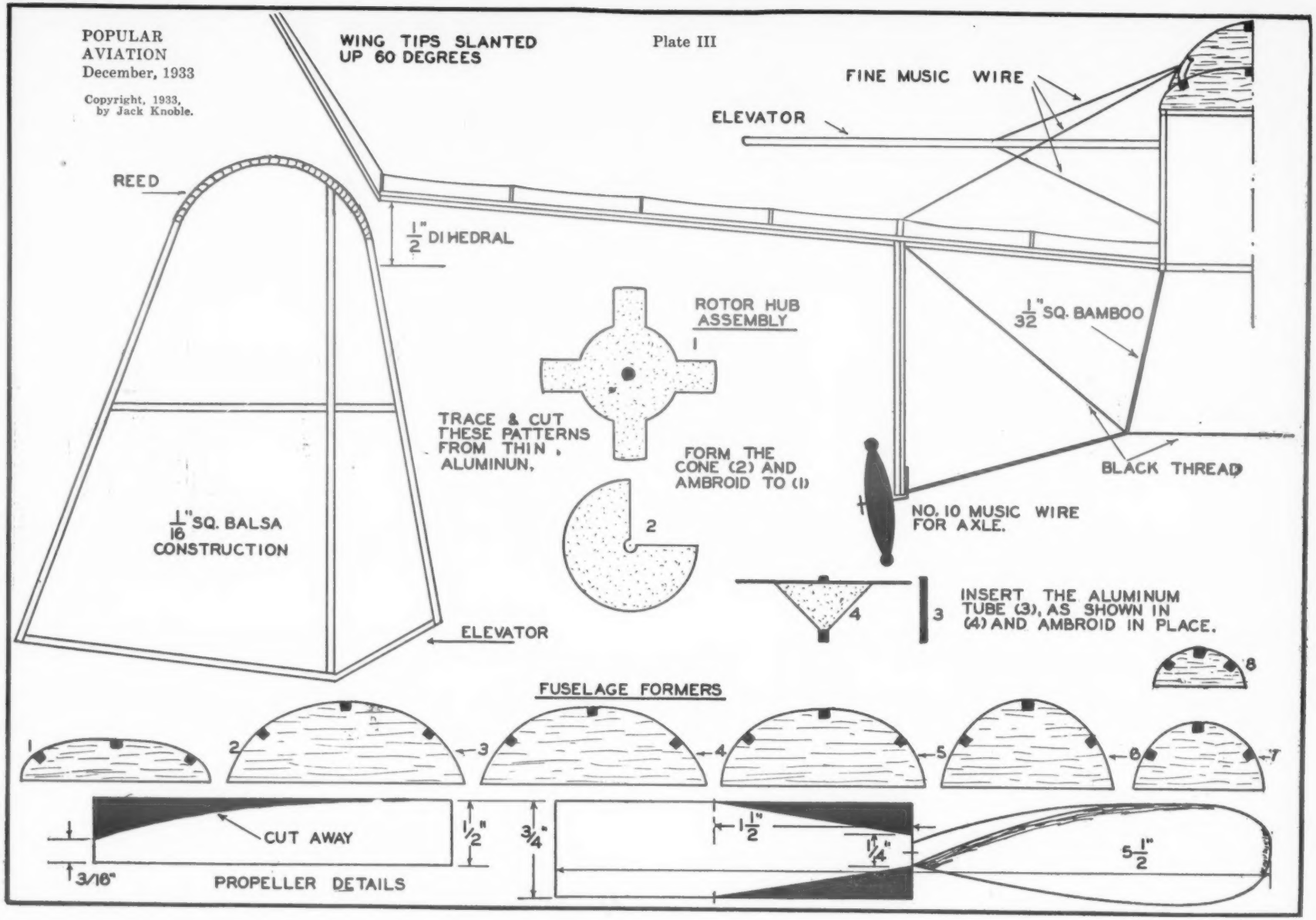
Plate I

Copyright, 1933, by Jack Knoble.

XUM



Copyright, 1933, by Jack Knoble.


POPULAR
AVIATION
December, 1933
Copyright, 1933,
by Jack Knoble.
Plate III
WING TIPS SLANTED
UP 60 DEGREES
FINE MUSIC WIRE
ELEVATOR
REED
1/2" DIHEDRAL
1/32" SQ. BAMBOO
ROTOR HUB
ASSEMBLY
1
TRACE & CUT
THESE PATTERNS
FROM THIN
ALUMINUN.
FORM THE
CONE (2) AND
AMBROID TO (1)
BLACK THREAD
NO. 10 MUSIC WIRE
FOR AXLE.
1/16" SQ. BALSA
CONSTRUCTION
2
4
3
INSERT THE ALUMINUM
TUBE (3), AS SHOWN IN
(4) AND AMBROID IN PLACE.
ELEVATOR
FUSELAGE FORMERS
1
2
3
4
5
6
7
8
CUT AWAY
1/2"
3/4"
1 1/2"
1 1/4"
5 1/2"
3/16"
PROPELLER DETAILS

Autogiro

(*Continued from page* 395)

PAPERING

PAPER the fuselage with a bright green paper, and inside the dotted lines, on the side of the fuselage, paper yellow. Wings are also papered with yellow tissue.

Spray a fine mist of water over the fuselage and wings to shrink the paper tight, then after they have dried give them a coat of banana oil dope.

The elevators are papered yellow, the fin green, and the rudder is yellow.

LANDING GEAR

THE landing gear is made out of 1/32 inch sq. bamboo and braced with black thread. There is not much strain on it, so there is no need to make it very flexible, although rubber strands may be used instead of thread.

Closer detail of the landing gear may be had by referring to the photographs. One inch celluloid wheels are used. Also brace the wing at the time of the assembling of the landing gear. Use fine music wire run from the third rib to the second longeron from the top of the fuselage. A wire is run from the leading edge and also the trailing edges.

The tail skid is bent out of 1/32 inch sq. bamboo.

MOTOR MOUNT

GET a two inch celluloid motor from your model supply house. Fit it to the nose at a 70 degree angle. Mount it on balsa to give it this angle, streamlining it to blend in with the nose. In front of the motor a 1 inch by ⅛ inch balsa disc is cut as shown on plate one.

Carve the propeller (block size—5½" x ½" x ¾") as shown on plate three. Cut away the black portions on the plans. The steps in carving are shown in halves. Use heavy music wire for the propeller shaft and strengthen around the celluloid motor by using 1/16 inch dia. aluminum tubing cemented in place.

FUSELAGE DETAILS

NOW cement the Tail sections in place using fine music wire for struts, as shown on the plans and photos. Paint in the steps for the cockpits. Take the rubber insulation off some electric wire and make an edge around the cockpit. Add the windshields.

Put two strands of ⅛ inch flat rubber in the fuselage and hook on the nose. Two pieces of ⅛ inch sq. balsa are cemented inside the nose-block to hold it in place. The tension of the rubber strands will hold the nose against the fuselage. Now cement the wing tips to the ends of the wings at a 60 degree angle.

(*Concluded on page* 420)

A Replica of the Stinson Reliant

by JACK KNOBLE

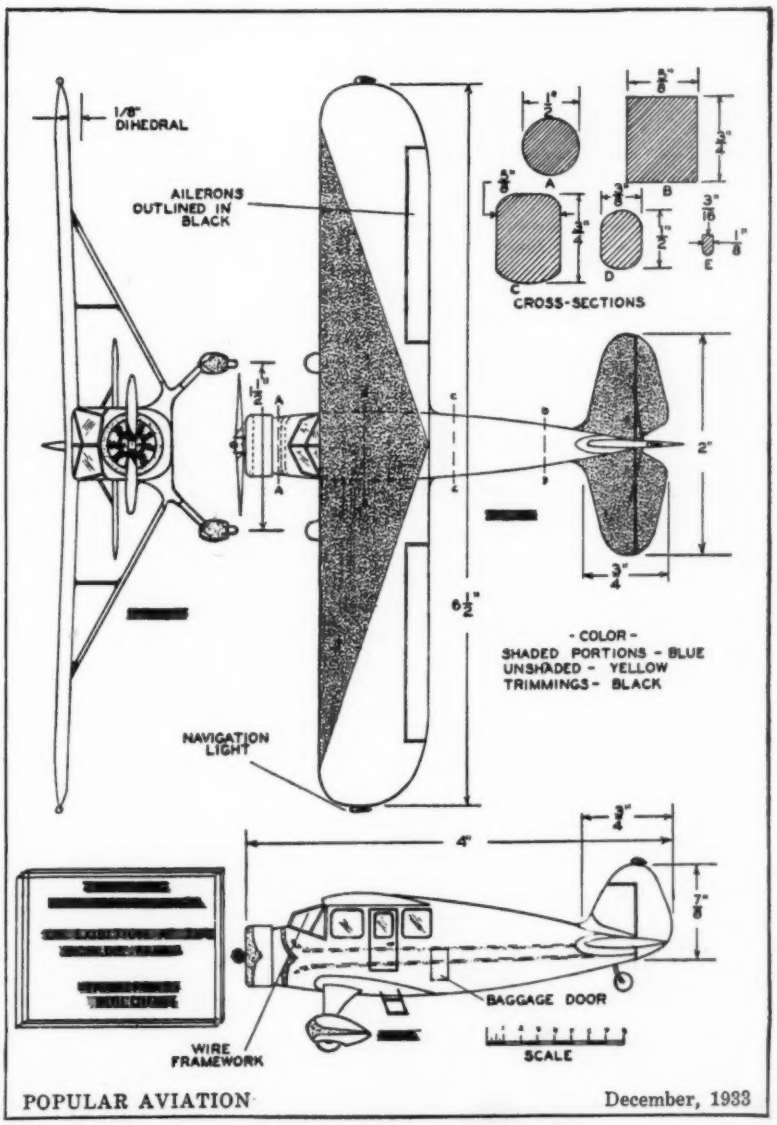
THIS replica of the Stinson cabin plane, the "Reliant," will prove to be one of the most realistic and beautiful little ornaments that you have attempted in the replica line. The drawings were prepared directly from the full-size ship on exhibition at the Century of Progress.

While it is easiest to carve the body and wings out of solid balsa, yet you will find that white pine takes a much better finish. Perhaps it might be just as well if you took a little more time and carved it out of the stronger and denser wood.

The section of the fuselage varies throughout its length as indicated by the sections. It starts out as a circular section just back of the N. A. C. A. cowl, then becomes rectangular, at the widest portion, then the corners are rounded off back of the wing and finally becomes an oblong section near the tail.

Great care will be required in carving out the landing gear boots and struts so as to give them a streamline section as was done on the original model. The wing is carved out of the solid and then is cemented into the recess provided on the top of the fuselage for this purpose.

The wing should be given an airfoil section, thick along the entering edge and very thin along the trailing edge by working it down with fine sandpaper, taking care to round off the entering edge to give it the proper nose. The elevator and other parts of the tail-group should be worked down by the same method.

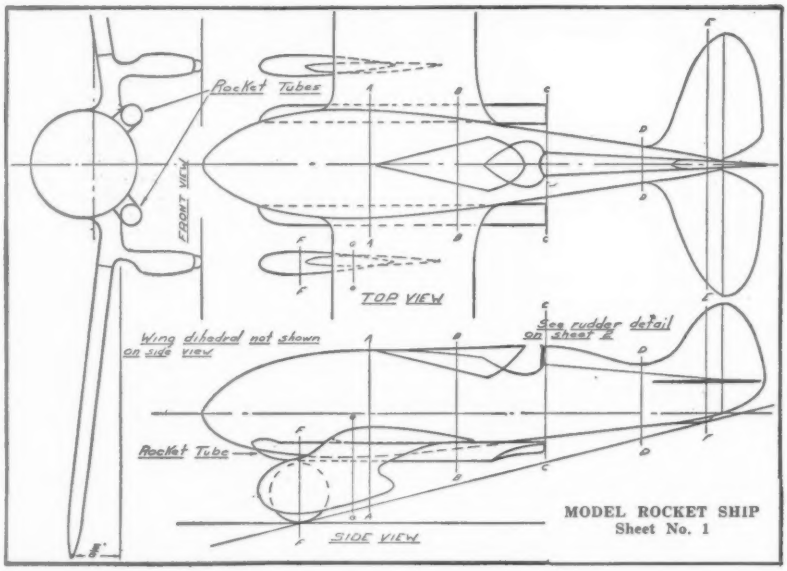


Here is a Model Rocket Ship

by

. K. A. COOK

***Specialist** in unusual models and in original model design.*



MANY engineers on two continents are working and thousands of dollars are being invested to harness the tremendous power stored in rockets. While the engineers are working on the real one we can take a peek into the future and build a model of what might be a representative plane ten years from now.

The design of the "Terra I" is based on research data now available and follows modern streamline practice. The rocket ship of the future may not look like our model, but it is a snappy job for the radio or desk.

Before starting the actual construction, a few suggestions might be helpful. Although streamlining can be done with plastic wood, it is much more workman-like to cut it out of wood using files and sandpaper. This also applies to joints. Sloppy joints filled with plastic wood not only show poor workmanship but also carelessness. So let's take our time and do a careful workman-like job on the model.

The fuselage is the basis of the model so we'll start with that. It is cut from a piece of pattern pine, 1½ inch square and 7 inches long. After the block has been squared up, lay out the pattern of the side on it. Be sure to omit the rocket tubes and headrest because they are put on afterwards.

When the profile has been cut out, lay out the top view and shape the sides. We now have a square block that conforms to the side and top views but every section of which is square or rectangular. Now shape the fuselage to the sections indicated A-A to E-E by rounding off the corners. This same procedure is followed in shaping all of the parts.

The headrest and fin are made in one piece as shown on Sheet 2. The rudder and horizontal surfaces are made of bass wood 3/32 inch thick and are streamlined as shown on Sheet 1. When assembling the tail to the fuselage, be sure that it is perfectly aligned with the fuselage. A brad dowel helps the cement in holding the empennage to the fuselage.

The wing consists of a right and left panel. Each panel is cut from a piece of pattern pine, ¼ x 2 x 4¾ inches. The wing tips are cut first then the panels are shaped to the section shown on Sheet 2. The real test comes in fitting the panels to the fuselage.

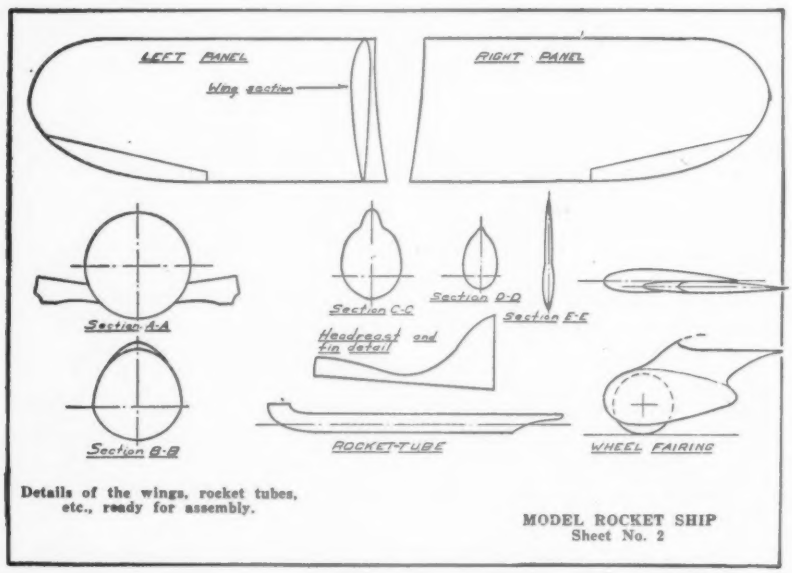
The general shape is shown but each will have to be cut to fit the particular fuselage for which it is made. The fillets may be plastic wood or cut from bass wood. The ailerons are indicated by thin grooves.

Each landing strut, wheel and wheel fairing is made in one piece. A hardwood such as oak, boxwood, or maple should be used. The same procedure for laying out the pants is used as described in laying out the fuselage. The pants should be shaped with round files, a knife, and sandpaper.

Assemble the pants to the wing panels in the position shown in the front view on sheet No. 1 with brad dowels and cement. We can now fasten the panels to the fuselage. This is a difficult job and pains should be taken to be sure that the panels are perfectly aligned.

The rocket tubes are cut from ¼ inch bass wood to the shape shown on Sheet 2. They are then shaped to a circular section and fastened to the fuselage as indicated. The windshield is only a suggested type and may be modified to suit the taste of the builder In fact any of the parts may be modified if the builder so desires.

END.



Details of the wings, rocket tubes, etc., ready for assembly.

What the Industry is Doing

Latest bulletins from the airplane, engine, equipment manufacturers and dealers boiled down into a nutshell. Contributions to this department are invited.

THE B-5 SPORTSTER, a new addition to the Kinner family which is a larger edition of the K-5 Kinner, has recently been awarded Approved Type Certificate No. 516 by the United States Department of Commerce. The new ship uses the 125 h.p. Kinner engine, has a top speed of 110 m.p.h., a cruising speed of 100 m.p.h. and a landing speed of 40 m.p.h. The Kinner Airplane and Motor Corporation, Glendale, Calif., is going into production with these ships immediately.

WACO PLANES are gaining in Argentina, an order for four more planes in Buenos Aires being reported by Waco Aircraft Company, Troy, Ohio. The first plane sold in Argentina, a Taper Wing Waco delivered in 1929, is still in service.

POWERED with a 40 h.p. Continental engine, a Taylor Cub monoplane recently broke the world's endurance record for lightplanes. It was piloted by Miss Mary Campana, 19 year old girl of Youngstown, Ohio, who stayed aloft for 12 hours, 28 minutes, thus adding one hour, eleven minutes to the previous lightplane record. The Continental motor continued functioning perfectly until the gas gave out.

STELLITED EXHAUST VALVE SEATS have endured runs of from 5,000 to 10,000 hours before regrinding or finishing of the valve has been necessary. Ordinary cast iron exhaust valve seats ordinarily must be renewed every 500 hours.

RECENT TESTS made on the new Lockheed Orion show that it has a top speed of 226 m.p.h. and a cruising speed of 200 m.p.h.

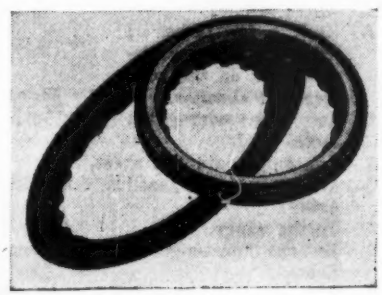
R. E. Lorenzen, Niles, Mich., exhibits a wide range of sizes in his products.

A NEW MONOCOUPE powered with a 145 h.p. Warner engine has developed a top speed of 170 m.p.h. This is real speed for a plane powered with such a small engine.

PAN AMERICAN AIRWAYS SYSTEM will immediately start a major development program involving expenditures in excess of $5,000,000. A new station to be built in Miami, Florida, will be the first unit built under this program and will cost $250,000. In addition will be contracts amounting to $1,750,000 which were recently awarded to the Sikorsky Aviation Corp., and to the Glenn L. Martin Company for the construction of the six transoceanic Clipper ships.

A PACIFIC LINER recently carried a fleet of new Vought "Corsair" planes to China. While the traditional enemies of China, the Japanese have been developing ships of their own manufacture, China is depending upon the United States for her planes.

IT IS CLAIMED by the General Tire and Rubber Company, that the Chinese authorities have decided to specify General streamline tires for the airplanes that are to be delivered to them. C. J. McCarthy, chief engineer of the Chance Vought Corporation claims that the streamline tires add to the speed and that they have a distinct advantage on soft ground.



A stellited exhaust valve seat.

THE TAPSTER is a new self-tapping screw of hardened steel with a metal cutting tip. It is said to save from 40 to 75 per cent of the cost of assembly operations. It is designed to replace ordinary machine screws in assembly operations which include the fastening of sheet steel, machinery steel, brass, bronze, aluminum, die-castings, bakelite and similar materials. It is being distributed by the Kellogg Switchboard and Supply Company, 1066 West Adams St., Chicago, Ill.

EMPLOYMENT on American airlines shows an increase. Approximately 500 men have been employed this year above the number reported for 1932. This applies to scheduled airlines only and does not take into account the additional help taken on by airports, factories and other branches of aviation.

THE AVERAGE length of a passenger trip on an airliner is 327 miles, according to the U. S. Department of Commerce. In 1932, the average passenger trip was 282 miles, hence it seems that the public are discovering the advantages of air transport for longer trips.

Lady Hay is a believer in American engines and in the Continental engine in particular which powers her Waco plane. This Continental engine is gaining international renown.

BRAZIL has ordered seven more army planes from the Waco Aircraft Corporation, Troy, Ohio, costing $89,000.

RADIO SHIELDING HARNESS for aviation engines has been developed by the Westport Manufacturing Company, Glendale, Calif. This harness consists of magneto shields, ferrules, rubber glands and nuts complete. They can be used with either shielded spark plugs or spark plug shields. Harnesses have been produced for the Wasp, Hornet, Lycoming, Continental, Warner and Wright engines.

A 160 ACRE AIRPORT, costing $681,000 will be built at Portland, Ore., if Federal aid is obtained.

A NEW KELLETT AUTOGIRO, Type K-4, has been introduced. It is powered with a 210 h.p. Continental R-670 engine and shows a number of improvements over previous models such as reduced fixed wing area, strut-braced under-carriage, enlarged cockpit, faired pylon structure and a steerable tail-wheel. It has a top speed of 114 m.p.h., a cruising speed of 93 m.p.h. and a climb of 940 feet per minute, fully loaded.

A WIND-TUNNEL has recently been completed at the Worcester Reed Warner Laboratories, Case School of Applied Science, Cleveland, Ohio. It is approximately 30 feet long with a cross-sectional area of 81 x 81 inches at its widest part.

C. L. EGTVEDT has been elected president of the Boeing Airplane Co., Seattle, Wash., succeeding P. G. Johnson, Seattle.

XUM

THE U. S. COAST GUARD has been provided with an appropriation of $14,800,000 for equipment to prevent smuggling, this including the provision of 31 seaplanes.

AIR de FRANCE is a French air transport merger which comprises five of the largest airlines in France. It is a subsidized company, capitalized at $5,500,000 which will receive $8,600,000 from the French government during the next year. And yet they rave about "pork" in our country!

THE LOCKHEED FACTORY is operating at full capacity. Six Orions are under construction for the American Airways, a high-wing Vega is being built for the Shell Petroleum Company, while a new metal working plant has been opened for building the new all-metal twin-engined Electra, a transport designed to carry 10 passengers and mail.

THE ZAPON-BREVOLITE LACQUER CO. is a combination of the former Zapon Company with the Brevolite Lacquer Company.

A METEOROLOGICAL COURSE is being offered by the Boeing School of Aeronautics, Oakland, Calif. It covers all phases of meteorological subjects including weather-map making, forecasting and interpretation. It requires a total of 36 hours.

KARL ORT, York, Pa., is issuing a most interesting and valuable catalogue for which a charge of 10 cents is made. It is more than a supply catalogue. In fact it is an aviation encyclopedia.

LUKE FIELD, Hawaii, is the scene of building activity. Two new hangars are started while the three hangars formerly occupied by the 18th Pursuit Group at Wheeler Field will be moved to Luke Field.

THE VARNEY SPEED LINE, operated by Walter Varney and one of the pioneer lines of the west, has discontinued operations. This line ran between San Francisco and Los Angeles, and at one time was noted for the speed of its ships and the regularity of its schedule.

THE STATES AIRCRAFT CORP., formerly of Chicago Heights, Ill., has moved its plant to Center, Texas, and will resume the construction of the States monoplane.

CENTER, TEXAS, has begun the construction of a new airport containing 200 acres, which when completed will have a North and South runway 1500 feet long while the East-West runway will be 2500 feet in length.

R. E. LORENZEN, Niles, Mich., shows quite a divergence in the sizes of his products. The large propeller, 8-feet in diameter, was made for a 125 Kinner engine on the Herrick Vertoplane. The small four-bladed prop is for a 1 h.p. wind-tunnel motor made for Mr. Porter Adams of the N. A. A. Mr. Lorenzen says that he is getting excellent results from his advertisements in POPULAR AVIATION and that he is kept busy with orders for his well known propellers, both from airplane manufacturers and amateurs.

NEW SIGNAL LIGHTS are being developed by the Westinghouse Electric and Manufacturing Company for use in aviation. These are light-weight "eyes" giving a powerful narrow beam that can be used for signaling from the craft to ground, at distances up to five miles or as searchlights for picking out buoys and shorelines up to 300 yards distant. They are arranged with bases so that they can be mounted on either side of the cockpit, and operate on 12 volts.

P. A. Model Contest

(*Continued from page* 394)

Q. Where does the exhaust pipe end?
A. Under the wings.
Q. Is the rudder balanced?
A. No.
Q. Are the engines the regular Wasp engines?
A. Yes, but "suped-up" to 550 h.p.
Q. Are the two engines geared together?
A. No.
Q. With the engines out in front, what is carried in the engine nacelles?
A. The engine auxiliaries.
Q. Are there ventilating gills on the sides of the nacelle?
A. Yes.
Q. How are the engines started?
A. By a portable electric-starter connected to a stub sticking out near the top of the engine nacelle.
Q. What sort of handles are used on the doors?
A. Automobile type handles.
Q. Is the passenger cabin noise-insulated?
A. Yes.
Q. What are the license numbers?
A. Each of the 60 ships has a different number.
Q. Are any of the control wires visible?
A. Only a few inches of wire from the Flettner flaps on the rudder and elevator.
Q. Is any corrugated metal used.
A. No, only plain flat sheet.
Q. Where are the gasoline tanks located?
A. In the wings.
Q. Is the passenger compartment heated?
A. Yes.
Q. Are the windows in main cabin movable?
A. No.
Q. Are there any obstructions projecting above the floor?
A. One slight elevation.
Q. Do the arm-rests of the chairs fasten to the seat or to the side of the cabin?
A. To chairs.
Q. Are there lights in the ceiling or individual lights by the chairs?
A. Individual lights.
Q. For what purpose is the netting suspended near the ceiling?
A. For hats, light packages, etc.
Q. Are the propellers wood or metal?
A. Metal.
Q. What equipment is in stewardess' compartment?
A. Racks for magazines, paper cups, etc.
Q. How is the door in the nose fastened?
A. Hinged at left side.
Q. Is there an opening on top of the nose directly behind the nose door?
A. No.
Q. Is the tail-wheel connected with controls in cockpit so that it turns with the rudder?
A. No.
Q. How many ventilators are in the roof of the cabin?
A. Three on top and one flush type at each seat.
Q. Where is the window for the lavatory located?
A. On starboard side, just in front of baggage door.
Q. Which way does the rear baggage compartment door swing?
A. Handle is at left hand.

BOEING

The Boeing insignia, denoting the name of the builder. —(In black).

Q. Are the later models of the "247" equipped with two-blade props?
A. No.
Q. How is the radio compartment entered?
A. Trap door under nose, below radio mast.
Q. Are there grooves in the wing to receive the two front struts?
A. Yes.
Q. Is the front window, on either side of the compartment, larger than the other four windows?
A. No.
Q. How are the landing wheels held up?
A. Electric controlled ratchet.
Q. What is the outline or border around the last window?
A. Frame, which when removed, enlarges window opening for emergency exit.
Q. At the end of the aisle to the rear, there is a small rectangular object below the door-knob. What is this?
A. Jump seat for stewardess.
Q. Do both propellers revolve in the same or opposite directions?
A. Same direction.
Q. Is the floor of the cockpit on the same level as the main floor?
A. No. About 15 inches higher.

UNITED AIR LINES

The insignia of United Airlines placed on fuselage of the plane.

"YOU CAN BE YOURSELF IN A WACO, IT REFUSES NOBODY'S WHIM"

● *This advertisement was written by a* WACO *owner who didn't know she was writing an advertisement. It consists of excerpts from a letter written by Lady Drummond-Hay shortly after reaching England with her new* WACO. *We think you will agree that it is an inspired description of* WACO *qualities. Here is what this* WACO *owner says:*

"You should see them open their eyes when the WACO takes off like an eager bird, winging upward in the well-known steep WACO climb. At about 2,000 feet, I tell them to pull back the wheel, back, back—50 m.p.h.—40 m.p.h.—35 m.p.h."

"That's enough," they say.

"Not a bit of it," I retort, "back some more." Zero says the airspeed indicator. "Now hold it and take your feet off the rudders," I continue.

"Of course, they expect the ship to drop one wing and fall in a spin. But the WACO just sinks gently and quite squarely with no forward speed at all."

Flying with "hands and feet off"

"I fly the WACO Cabin 'hands and feet off' for long periods. I can take the greatest liberties with it at low speeds. In a stall, it develops no vices whatsoever. Yet its maneuverability and light controls satisfy the most inveterate stunt addict. You can fly high and fast or low and slow with equal safety. You can stunt it or load it up to the nth degree with family, friends, baggage, or sport equipment. That's what makes it everybody's ship—a ship that anybody and everybody can fly safely in all circumstances. You can be yourself in a WACO. It refuses nobody's whim."

$5,985
FLYAWAY
TROY, OHIO

To an inspiring description like this, there is little that an advertising man can add except to remind you once more that you get the WACO "ready to fly—no extras to buy," and to suggest that you fly the WACO at your first opportunity.

Dealers Wanted

With WACO sales climbing steadily month after month, there is a splendid opportunity for well-qualified dealers. Write for details of the WACO franchise. You will find it a real proposition. The Waco Aircraft Company, Troy, Ohio.

WACO AIRPLANES
"ASK ANY PILOT"
WACO LEADS IN AIRCRAFT REGISTRATION

Airy Chat

(*Continued from page* 354)

and instructions accompany each of these plans.

Then, beside this model drawing, are a multitude of articles dealing with model-making in all of its branches. Large, clear illustrations are included in every instance, adding greatly to the value of the articles. This is not a catalogue—it is a full size peppy, interesting and useful magazine.

* * *

GLENN ANGLE, America's most noted authority on aviation engines and the author of many treatises on aviation powerplants, has written a most interesting article in this issue of POPULAR AVIATION. It is a forecast as to the outcome of present aviation engine problems and goes extensively into modern trends in design. This article is very instructive and yet is of a non-technical nature that all of our readers can easily understand.

BAT-WING JR.

New ICE-BOAT Sensation Built in 3 DAYS at Amazing Low Cost!

The BATWING III

YOU can build this new, sensational front-steering Mead Ice-Yacht in 3 days at home from complete knock-down Kit at low cost! No experience needed. The Batwing III speeds 75 m.p.h.—carries 90 feet of sail—seats 2 comfortably—and can be dismantled for auto travel in one minute, re-assembled in 8! Safe in heavy winds yet sensitive to lightest breeze! BOY—what a genuine thrill you're going to get sailing Batwing III!

Don't waste time on hard-to-build, obsolete or un-proven ice-boats! BATWING III is a tested, PROVEN ICE-YACHT! Has new "quick-assembly" method—latest "front-steering" NON-SPIN design—easy riding. Take her down in a jiffy and put her up the same! You don't need to live ON a lake—just within driving distance. Think of that. Costs little yet out-sails and out-classes "home-made crates" twice its size!

PORTABLE!

WRITE TODAY!

Be first in your locality to sail this WONDER ICE YACHT Don't wait another minute. FIRST get all the facts—send10c today for descriptive CIRCULAR. Remember advancing prices may soon raise the LOW cost on BATWING III—so you will be wise in acting at once!

Photo shows BATWING III dismantled for travel.

MEAD GLIDERS 12 South Market Street Dept. E-123, Chicago

MANUFACTURERS OF FAMOUS MEAD "KI-YAK"

ALL AUTHORITIES are well agreed upon the fact that the airplane is not the ultimate solution of the flight problem, but are at variance in their opinions on just what form the airship of the future will take. As your guess is just as good as theirs, we would like to have an expression of opinion from our readers on this subject. Tell us what you believe will be the ritzy air vehicle in 1950.

* * *

WHILE MANY of our readers have probably not thought very much about the impelling energy back of an airplane flight, no one can deny the fact that gasoline is one of the most important factors involved in flight. If there were no gasoline, there would not be much flying done today.

But in the course of time, it will be necessary for us to seek some other type of fuel, for the crude oil is becoming exhausted and very few new productive fields are being found. Alcohol is altogether out of the picture because, to produce aviation alcohol, it would be necessary to get labor for less than four cents per day in order to harvest the necessary vegetation for the distilleries. Rather looks as if the steam engine would ultimately become the only available source of power for the airplane.

* * *

SOMEBODY HAS discovered, or claims to have discovered, that all of the licensed aircraft in the United States would not have a sufficient capacity to carry all of the pilots licensed up to the present time. In other words, if all the men and women who have carried a license were to go out on the fields some Saturday afternoon, there would not be enough planes to carry them all at the same time. Here's one place in history where the demand greatly exceeds the supply. What a business there would be if the pilots only had the money!

* * *

SEZ Mark Malloy, "the crew of an airliner consists of the pilot, co-pilot and cow-pilot," By the latter, we assume, he is speaking of the stewardess.

* * *

Member Aeronautical Chamber of Commerce

Manufacturer of Progressive Aircraft Finishes

SAFETY IN THE AIR AND ON THE GROUND

REQUIRES MAXIMUM VISIBILITY OF THE PLANE AT ALL TIMES

ONLY ORANGE, YELLOWS AND REDS

WILL GIVE THIS TO YOU

BERRY BROTHERS

PAINTS • VARNISHES • ENAMELS • LACQUERS

DETROIT, MICHIGAN WALKERVILLE, ONTARIO

THIS issue contains eight more pages than our previous issue, hence we are printing just that many more stories and pictures than in previous issues. In our next issue will be the full page photograph. We are getting bigger and better right along.

AMONG the various questions received by the Q. & A. department, this month, was a poser. This stuck our advisory committee, so we're passing it on to you. "What prevents a pilot from jumping when he knows that the ship is going to crash?" Search me, I can't tell you.

* * *

WHERE regular air line schedules must be maintained, the problem of de-icing the wings becomes of importance. In this issue, we have an illuminative article on this subject that tells of the experiments being conducted and how they are conducted, in arriving at a solution of the de-icing problem.

* * *

WE have started two new departments in this issue which we believe will be welcomed by our readers. First, we have a special department in which we publish abstracts from the interesting letters received from our readers. Formerly, these letters were incorporated as a part of the Airy Chat, but they became so numerous that it became necessary to give them a special corner in the magazine in order to do them justice.

Second, we are starting our new notebook pages which will prove a handy reference for our studious readers. All sorts of subjects pertaining to aviation will be included in this new series so that you will have a veritable encyclopedia of useful facts at your command. Hope you will like them.

* * *

WE'VE pulled in some more "Dinkys," which is short for Dinklespiels. They are hot stuff. First to offer himself for inspection, is A. A. Askew, Jr., Box 72, Barrytown, N. Y.

Snob Pilot
Tried Loop.
Smash! Crash!
Boop-a-Doop.

* * *

Schmidt hopped.
Air—record.
Motor flopped,
Now Wreckered.

* * *

"For years and year, I have nobly suppressed any tendency toward Dinklespiels," says Joseph F. Morris, Selah, Washington, "but now you have got me started again. May the sin be on your head, for this is the preliminary barrage. Standby for a strafing.

Too close
Power line.
New angel
Doing fine.

* * *

Barnyard landing,
Messy crash.
Makes cow
Cornbeef hash.

* * *

"Remember," says he, "this is only the first of a long series of atrocities. I'll bomb you regularly from now on."

* * *

See you here next month.—J. B. R.

SCINTILLA
AIRCRAFT MAGNETOS

are standard ignition equipment on every engine manufactured by The Pratt & Whitney Aircraft Co.

Makers of Wasp and Hornet Engines

SCINTILLA MAGNETO CO., *Inc.*
Sidney, New York
Contractors to the U. S. Army and Navy
(Subsidiary of Bendix Aviation Corporation)

The Ideal Xmas Gift →

The JANUARY Issue

THE January issue of POPULAR AVIATION will contain many new features in addition to the permanent features started in this issue.

There will be a dandy article by T-2003 on the new method of blind landing adopted by the U. S. Army Air Corps. Glenn Angle will resume his most important article on aviation engines which is a college course within itself.

And There Will Be a Full Page Picture of a Late U. S. Military Plane.

For the casual reader, there will be an excellent World War story, and an article dealing with a new activity or field of action in aviation. We'll not announce the title yet.

Then, we'll have the technical description, with the three-view dimensioned drawing, of the latest Boeing pursuit, P26A, which will be featured on the cover. The P. A. notebook will have four new leaves of great importance. This issue will be of surpassing importance to everyone connected with or interested in aviation. And the best way to insure getting a copy of this issue is to fill out the coupon below and mail it today.

POPULAR AVIATION 11-3
608 S. Dearborn St.,
Chicago, Ill.

Please enter my subscription to POPULAR AVIATION for five months. Send me a bill for $1.00.

Name .....
Address .....
City ..... State .....

Engines

(*Continued from page* 358)

little or no supercharging effects. This results in marked improvements in gas distribution and in smoothness of engine operation. Thus, in the larger radial units, some form of rotary distributor or supercharger has become universally employed and it is expected that we will see similar constructions among the smaller engines of this type just as soon as costs will permit.

NOT so many years ago, a question frequently debated was whether an aircraft engine should be cooled directly by the air passing over its surfaces, or through the medium of a liquid which dissipates the heat of the engine to the air by means of a radiator. Despite the claims made by both sides in this controversy, the fact remains that both types of cooling have features and limitations clearly defined by experience and the choice rests in each individual case with their suitability for the type of engine and its power output.

Air-cooling should be the choice wherever it doesn't lower the overall efficiency, as for example through power losses due to ineffective cooling or too much drag. By ways of simple explanation, it seems about as appropriate to employ water-cooling for aircraft engines as it would to adopt air-cooling for marine engines. Of course, this is hardly a fair manner of presenting the idea; nevertheless it serves to illustrate this particular point. Why shouldn't use be made of the cooling medium that is most plentiful?

For some time after the great world conflict, few air-cooled radial engines were available and the more highly refined water-cooled aircraft engines were naturally favored because they operated more efficiently and were much more reliable. However, as solutions for the more serious problems in the air-cooled types were discovered, their use rapidly increased. Now, they not only dominate the engine field, but the records show around 52 per cent of all aircraft models for all time belong in this category.

In the writers opinion, all aircraft engines having outputs under three-hundred, or possibly four-hundred horsepower, should be air-cooled for reasons of efficiency and economy. In the power range up to six-hundred horsepower, the engines may be either air or liquid-cooled, with the balance of choice with air-cooling because of the favorable position enjoyed by the radial type. Both forms of cooling will be employed for engines ranging in the outputs from six-hundred to eight-hundred horsepower, and while the air-cooled radial seems to command the most attention in this power class at present, it is expected that liquid-cooling may soon gain considerable popularity.

Liquid cooling will be the logical choice for most types of engines delivering more than eight-hundred horsepower, because the advantages in cooling directly by air have practically vanished in this higher range of outputs. We shall undoubtedly see experiments with large air-cooled engines in the future, but no matter how successful the results, it is still believed they will never look well in comparison with an equally well designed liquid-cooled engine of the same horsepower.

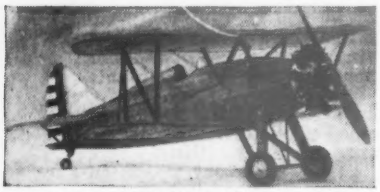
It is unnecessary to enter into an exposition of the advantages of air-cooling just to explain the reasons for the opinions expressed. The suitability of this method of cooling for certain types of engines, in the range of power outputs to which we have just referred, should be readily understood from observation or experience. Anyway, these features have been brought to the attention of almost everyone on numerous occasions during recent years by written or spoken words, to which very little or any importance could be added.

EDITOR'S NOTE. *The next installment of Mr. Angle's analysis of future progress in engine design will be resumed in our next issue. The present installment is introductory. The concluding installment in the next issue will contain the conclusions arrived at by this internationally known and recognized aviation engine expert.*

END.

ALL YOU HAVE TO DO

Is read to the end of this advertisement, and you'll agree that your time is well spent.



BOEING P12-F

Authentic model of the Army's latest ship in the P12 series, recognized as one of the fastest fighters in the world. Kit includes all ribs, bulkheads, etc., printed on balsa, ready made balsa wheels, ready bent wire parts, semi-carved prop., insignias, two colors tissue, banana oil, cement, washers, rubber motor, sheet cell., balsa strips and sheets, and full size, detailed plans.

14" Boeing P12-F kit, p. p.....$ .50
24" Boeing P12-F kit, p. p..... 1.00

MONOCOUPE 110

Both pictures are unretouched and show the models as they really are—not merely as you would like them to be. Beginners and experienced builders alike will get a thrill building and flying these models. THEY'RE REAL!

OTHER FALCON MODELS
(All kits snt postpaid)

24" Monocoupe 110.....$1.00
24" Sopwith Camel..... 1.00
18" Lockheed Orion—special gift box..... .85
15½" Howard's "Ike"—special gift box..... .85
14" Monocoupe 110..... .50
14" Sopwith Camel..... .50
14" Wace "C"..... .50

NOW REMEMBER, each kit mentioned in this ad has every article listed in the Boeing kit, and is guaranteed to be complete. If you are not satisfied, your money will be refunded promptly.
Make this a "model" Christmas for you and your friends.

FALCON MODEL AIRPLANE CO.
9619 Division St. Portland, Oregon

BALBO'S ARMADA

Models Ready Built

We are first to offer solid scale models of the famous Savoia-Marchetti. Completely assembled, including wire riggings, movable controls glossy finished in silver and black, etc. Be the first to get a model. These models make excellent souvenirs, radio ornaments, or display purposes.
6" Models, $1.00*, P. P.; 10" Model, $2.00, P. P.; 14" Model, $3.00, P. P.; also 8" Curtiss A-8 Attack, $1.50, P. P.; 7" Curtiss Hawk P-6E, $1.50, P. P.
*Do not include movable controls. Price list, 5c

MOUNTAINEER MODELING CO.
370 High Street Morgantown, W. Va.

Aero-Sportswomen

(*Continued from page* 366)

on October 7th, the opening day of the Air Races.

* * *

Fifty-one members of the "99" organization attended the annual meeting held at Santa Monica, California, during the National Air Races. Amelia Earhart, national president, presided.

After other business had been taken care of, nominations were made for the new officers. A ballot was prepared and mailed to all members of the organization. The returns of the election shows the headquarters will be securely settled in the West for the coming year, with:

Margaret Cooper, Beverly Hills, Calif., President; Gladys O'Donnell, Long Beach, Calif., Vice-President; Lauretta Schimmoler, Glendale, Calif., Sec'y-Treas.

* * *

The *Aero-Sportswomen* is becoming internationally minded, we have had several interesting letters from Fay Gillis in Moscow, (We cabled her to interview Ann Lindbergh recently, but unfortunately Fay was in Tashkent at the time) and now Sig. Emma Encinas, Mexico's only woman flyer who edits a similar page in *Anahuac*, an aviation magazine published in Mexico City, has offered to tell us something of flying under the Southern Cross. And when Amy Johnson completed her Bagdag flight, we hope to have a story of her experiences, trans-Atlantic and otherwise.

* * *

The editor of this column had the pleasure recently, of giving a talk about "Women in Aviation" before the Business and Professional Women's club of Evanston, Illinois. We were highly amused to find the account in the newspapers the next day calling us the editor of "The Arrow Sportswomen." Perhaps we should change our name, for if this N.R.A. business fails to go over we might as well take up archery!

END.

NRA MEMBER U.S. WE DO OUR PART

NORTHROP GAMMA MONOPLANE

You can Build Perfect Models in Half the time with this

Tru-Bild Plan

A TRADE MARK REG. U.S. PAT. OFF.

BELLANCA MONOPLANE

. . . a new, patented method of building models that eliminates the hard, tedious work and enables you to turn out an absolutely true and perfect model in less time, and without breaking your material. The "Tru-Bild" Plan is the easiest and quickest way to build up the fuselage, wings, tail assembly and other parts. You build right on the Plan. Thumb-tack the forming jigs (which are furnished with each Plan) right on the Plan where indicated, place the balsa in the jigs and cement together. When dry, just lift the finished part off the jig! It's the easiest thing you ever saw . . . builds models in no time at all . . . without trouble or difficult work!!

Two Wonderful 16-in. Flying Models Now Ready in "Tru-Bild Kits

NORTHROP GAMMA and BELLANCA MONOPLANES

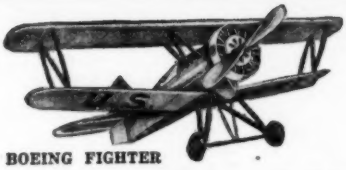
60c EACH POSTPAID

These are the slickest, smoothest models you ever saw; every stick in perfect alignment. Kits contain all materials and parts for each model; printed balsa sheets, balsa strips, colored Jap tissue, hardwood wheels, semi-finished balsa propeller, cement, full-size Plan with Instructions and the Patented "Tru-Bild" forming jigs.

Send right away and get one of the remarkable Kits for Christmas. See how easily and quickly you can build better models!

IDEAL AEROPLANE & SUPPLY COMPANY, Inc.

22-26 West 19th Street, New York
Canadian Branch: 3007 St. Antoine Street, Montreal, Canada
DEALERS: Write for full details of this new, patented money-maker; get posted on complete IDEAL line.



BOEING FIGHTER

Your Choice of 10

IDEAL-O-PLANE

Flying Models

Heath Parasol	British S. E. 5
Fokker D-VIII	Puss Moth
Curtiss Sparrow Hawk	Sopwith Camel
Monocoupe	Fokker Tri-Plane
Boeing Fighter	Polish Fighter

Any 2 Kits 60c POSTPAID

(West of Denver, add 10c extra for Long Distance Postage.) Please do not send stamps.

These are the famous IDEAL 12 in. and 15 in. Flying Models, proclaimed by thousands of builders to be the best flyers and most perfect kits. Very easy to construct and kits are complete in every detail. The biggest Model Airplane value possible to offer. Pick your choice of any two kits and send your order now.

The Akron

(*Continued from page 362*)

out of a squall—or to edge out of it, if one has been unwisely caught in one? Foreign experts are ready to say "yes" to both these questions, even though the answer to the second involves confession of a partial failure. They have had many years' experience, many ships, and few serious failures—and that was a long time ago, before they had acquired airmanship.

One can visualize their watching for the squalls day and night—for these may come most unexpectedly—and how they have fought in the squalls, for a balance, for a side-slip, full speed ahead for a lift on the tail—or the reverse, or full speed astern for the same purpose. It takes a cool head for all this, and more than that: a great deal of knowledge and experience. It is the sum of all this that makes for airmanship.

However, it is not fair to place the entire task in the hands of the navigators, for surely the designer and the builder must place in his hands a trustworthy machine in order to insure good results always. Suppose the Akron had been better built, better designed—all intelligent and honest work, entirely beyond suspicion, like Caesar's wife She might then have drifted to, or near to the water's surface, where the force of the squall would have had to dissipate, and from there have risen again in glory.

Did the squall break the frame; did the broken frame puncture the bags and deflate them? If so, she could not have risen again. One may say that airship construction in the U. S. has been so spasmodic and erratic that there has been no chance to develop airmanship; so much less reason for the designers and builders to place all the burden on the navigators and to assume none themselves. It has been spasmodic because the designs have not inspired confidence.

There is a great deal yet to be done by the builders of airships as an aid to airmanship. Their method of design being still semi-rational only, they should check up on the stresses during flights, and by this aid make the frames more trustworthy. They should check the transverse frames specially for stresses induced by the longitudinals, for on this point the theory is weak and has not been checked. They should revise the methods of suspension so as to provide for safety under severe and uncontrollable pitch, and this regardless of bending in this position for normal flight.

They might also learn from the blimps, that there is greater safety in less rigidity, that the very fact of their limpness makes it easier for the squall to shove the ship aside without doing it injury. The frames in other words should be made more resilient, and this applies specially to the transverse frames which are dangerously rigid and therefore doubly lacking in strength.

Now let us look at airship design fanaticism: we copied the Shenandoah from foreign designs, 2,148,000 cu. ft.—it came down because we lacked airmanship and experience—we then built the Akron, 6,500,000 cu. ft., and this before we had developed the airmanship needed for successful management. The two were only a few years apart.

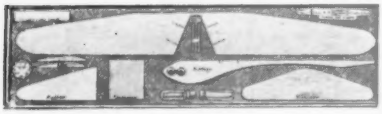
Not only did we thus decline the chance to acquire airmanship, we also refused to build, to observe, to check up on errors, to learn and to build better, which is the usual way of engineering and progress. In one step, we trebled size without learning the lessons from intermediate steps. What contemptible sportsmanship then for the builders to blame the dead navigators!

END.

NEW BROADFIELD

Oh Boy!—What a Soarer—What Performance—Throw it against the wind and watch it zoom high in the air and soar smoothly away. Strongly constructed like a contest glider—selected balsa, cambered wing—all surfaces smoothly sanded. N.R.A. insignias on wings. Satisfaction guaranteed. Built ready for flight or in Kit form. Ask your dealer or order direct from factory.

"ZOOM" SOARING GLIDER KIT 25c Postage 10c



Here is a Quality Glider Kit that builds the glider pictured above. Picture below shows cut to shape parts ready for quick and easy assembly. Only finest grade "A" balsa used. Complete Kit 25c at dealers or order direct (Postage 10c extra).

Member M. A. M. Association

Dealers—Write for Prices

Mfg. by

BROADFIELD MODEL AEROPLANE CO.

Yale Street, Hempstead, N. Y.

Altitude Flying

(*Continued from page 360*)

severity of desert nights should follow immediately on blistering days; and some wonderment is occasionally expressed by those who see high altitude pilots going aloft of a summer's day, clad in the apparel which they wear. But when these men reach the altitudes of from four to five miles, they have vital need for every ounce of clothing they have donned. The same is true of the oxygen they carry. Thorough preparedness becomes a second nature to the men engaged in this crucially hazardous profession.

Circling, soaring, dipping or advancing in level and rigid flight, the military airplanes may be seen above March Field. Bombing and pursuit planes, singly, or in regular war formation. Climbing cloudward, or dropping to lower spaces, practicing the maneuvers they would employ in actual conflict. It is an impressive sight. Each plane obeys the guiding hand of its pilot as perfectly as a sailing yacht responds to its skipper at the wheel of the craft.

Into the upper regions of air where the atmosphere grows thin and icy, these broad wings penetrate, far over the clouds that float below. They wheel and poise, swerve, ascend, and sometimes, for a brief space, seem to hover in one place, as the little prairie hawk poises stationary, for a short time, above the treeless plain. But for the very greater part the planes are in motion.

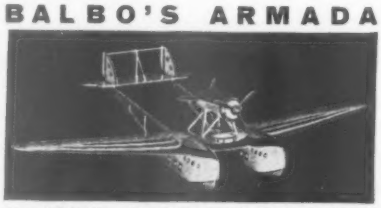
It is in this manner that they will fly in actual warfare while watching, scouting and protecting their heavier and slower convoy which will necessarily fly below them.

Yet always there is the stamp of immense energy and unlimited reserve power about these aerial craft. Dumb, menacing, pitiless they seem sodden and lifeless enough in their hangars, their huge pinions out-stretched like the wings of enormous dragon-flies. But as they roll forward to swing into their undisputed mastery of the air, they seem curiously endowed with almost a latent sense of sovereignty.

Inevitably their presence on high suggests a vision of conflict. Before they rise, this is emphasized in some of them by their sinister insignias. They are as nearly allied to indications of war, as a battery of shining cannon. Day in and day out, the sky above March Field is winnowed by the wings of the great planes, sailing over the surrounding country, and going through their maneuvers. And at times, owing to the altitude they reach, they are lost to sight, so far have they pierced to the distant heights beyond which stretch the unknown realms of mystery.

END.

BALBO'S ARMADA



Crescent Model Aircraft now offers you the only Savoia-Marchetti model, made from plans imported from Italy. This model is guaranteed to be a 100% perfect reproduction.

Complete Kit for 13¾" wingspread model only $ .95 Postpaid

Kit complete including 2 special finished propellers.

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1805 Benson Avenue Brooklyn, N. Y.

Selley's Exciting Xmas Values!

Talk About Bargains!

Genuine Selley Kits

25c EACH Postage 10c on 2

REAL FLYERS! 14" span

Six Beautiful Models—

Aeronca
Buhl Bull Pup
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Heath Parasol
Curtiss Navy Racer
Verville Air Coach
FAIRCHILD

Like all Selley kits they are complete with all materials full size plans and complete building instructions. Order NOW.

NEW! SENSATIONAL FLYING KITS 50c EA.

The Choice of the United States Government Commercial Contest Models

These new models are sensational in their flight performance. Flights over 300 feet are GUARANTEED with these snappy, LARGE, long distance flyers, with their large slow-winding propellers and bright colors. These models are the choice of the most critical model builder and judge. Each kit is complete with special turned parts, printed balsa sheet, spray balsa, colored jap paper, rubber, cement, insignia and everything necessary to construct any one of these models.

Postage 10c ea.

Boeing P12
15" Wingspan
ASK YOUR DEALER

SELECT YOURS NOW!

Hawk P6-E
15" Wingspan

HERE, TRULY IS THE BIGGEST VALUE EVER OFFERED IN AUTHENTIC SCALE FLYING MODELS.

95c each Postage 10c

ALL 18" WINGSPAN

These beautiful, speedy, Selley masterpieces embody a new, simplified method of construction—the "Bi-Form Method." Complete with full-sized 3-view plan, special machine turned balsa cowls, props, hub wheels, etc., cement, music wire, reed, bamboo, balsa sticks, insignia, etc. What a bargain!

Curtiss A-8 Attack

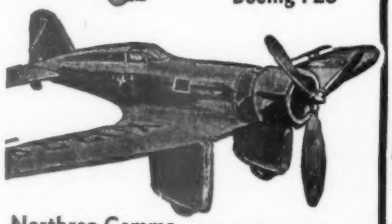
Gee-Bee Super-Sportster

Wedell Williams

18" Wingspan

ALL **95c** each

Boeing P26



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The World's Best Model Kits are inexpensive today!

Curtiss Wright Series

FALCON Flying $1.25 — 18" Wing Span

BELLANCA AIR BUS $1.25

22" Wingspan

SPACE PROHIBITS ILLUSTRATING

FLYING HELL-DIVER, 24" Span	$4.00
BELLANCA SKYROCKET, 14" Span	1.00

Replica Model Kits

12" Wingspan

HAWK	$1.00	FALCON	$1.00
		HELL-DIVER	$1.00
*SPAD	$1.25	ALBATROSS	$1.25
FOKKER	1.25	NIEUPORT	1.25

CONDOR, 34" Span	$7.00
CURTISS HAWK, 25" Span	$5.00
MYSTERY "S", 25" Span	$5.50

Postage 15c each Kit

Glider Construction Kits

Primary Glider
38" Wingspan
Plan and All Materials.....$1.00

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Air Races

(Continued from page 366)

Now, undoubtedly, their actual experiences at the races reduced the desire for ownership in a four-to-one ratio. On the day before the races and on the way to the airport, 72 persons confessed a hankering for a plane of their own, but after the races started, only 18 hardy souls retained any desire to own a ship for pleasure purposes. Most of the 18 who still desired a plane had the money making angle, men and women who believed that they were cut out for race pilots, or who were possessed of a dare-devil spirit.

Laying aside the subject of the vital statistics, we will present abstracts from some of the letters received from our readers which will shed more light on the subject. In number, the letters were about 50-50, for and against racing.

* * *

J. C. BOYD, airport manager, got quite irritated with Mr. Brown's article. He as much as says so in his letter.

Say, what ocean did that fellow Brown cross? After he has been in American aviation for at least ten days he will understand that racing is all there is to aviation. When racing quits, aviation quits and POPULAR AVIATION *will quit along with us. When you birds learn to feather your own nest, you'll lay off the air races.*

Oh, very well. But I notice that the commercial transport lines are prospering without running races in connection with their business, and that they probably make more money in one day than all of the race pilots make in a year. And then, we are adverse to air races for the reason, that by so doing, we will be feathering our nest with increased aviation interest and increased business.

* * *

NOW, on the other hand, Mr. Brown is commended by Lester N. Nichols, Asheville, N. C., who has no uncertain views upon the subject.

The necessity for increasing the speed of airplanes each year at the air races has gradually led to freakish designs which have no practical use. In a practical air-cruiser for either private or commercial use there should be room for something beside the engine and the fuel tanks—let us say for the comfortable accommodation of one or more passengers.

Just look at a typical racing plane, preferably at one of Benny Howard's speed models, which are my private peeve. There is so little room that it is almost necessary to use a shoehorn to get the pilot into his cockpit, the landing speed is terrifically high and the whole affair is as flimsy as a pasteboard box. I, for one, most certainly do not call this abomination an addition nor a worthy development.

This, according to our ideas, tells the story in a nutshell. The development of a pure speed machine is one thing. The development of a machine to serve a useful purpose is another.

* * *

NOW comes another race fan, Karl T. Tuttle, who seizes an opportunity for backing up the races and their supposed benefits to aviation.

I was surprised and disgusted to find that a magazine like POPULAR AVIATION, *supposed to have the interest of aviation at heart, should publish a story like the "Air Race Racket."*

To my mind, the races are a wonderful publicity feature that spreads the glad news of the airplane and its achievements. Practically nobody would have any interest in aviation at all if it were not for the air meets. A few race pilots are killed now and then, to be sure, but so are pioneers in any other field of enterprise, the auto races not excepted.

Yes, it is publicity all right but not the proper sort of publicity. If we have become so callous and reckless with human life that the killing of several young men and women is of no consequence, perhaps you may be right. But, we cannot accept the idea of these pilots being pioneers. They are not pioneers nor have they any place in the development angle of aviation.

* * *

AL KOEHLER, Denver, Colo., writes in and laments Mr. Brown's article. He thinks that air races are an essential part of modern life and should therefore be continued.

We have auto races that stimulate interest in automobiles, horse-races that have assisted in the breeding and development of horses, motor-boat races that assist the boat building industry, and so on.

Therefore, it seems logical to me that the airplane industry should promote air-races for their own good just like other industries, and this is effective in giving us an air-minded public who are boosters for aeronautics and the airplane. If a race pilot is killed, then that is his own fault for he fully understood the hazards of the game before he started in. The number of deaths is inconsequential.

Still we do not believe that racing has advanced the development of practical boats, automobiles or even horses. The race-horse is just one more example of a freak development that is of no use but in racing. It is better to develop the Clydesdale or Morgan strain than to produce skinny legged thoroughbreds that can only perform on a track.

Even though the air-races are the main attraction of aviation, they have brought pitifully small returns to the large air-meet operators during the past year. This is not because of the depression but to the fact that the novelty is worn off and that the races have nothing worth while to offer.

END.

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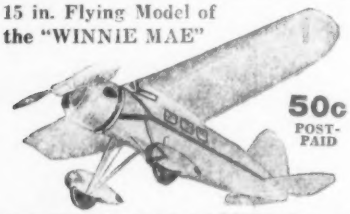

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Practical Lessons

(*Continued from page* 382)

more uniformly distributed. Thus, if the coefficient for a flat square disc is 0.00152, then the coefficient for a flat circular disc will be about 0.00138. This is subject to the same size corrections.

The total resistance presented by any object can be divided into two components. First, that part due to breaking up the air-stream and forming eddies, and second, the resistance due to the friction of the air when rubbing over the surface. The latter has little to do with the normal flat plates discussed so far, but it is apparent in solid bodies of considerable length along the air-stream. When the plates are inclined to the air-stream, instead of being at right-angles (normal) to it, the pressure is broken up into two components, which when used as wings, give the "lift" and "drag."

The same general formula applies to the solid bodies but ordinarily, it is more direct and simple to use the coefficient (K) based upon miles-per-hour than the coefficient (C) based on feet per second for the reason that the speeds of airplanes are more commonly given in terms of miles-per-hour. The mile-per-hour unit (K), when multiplied by a constant, will give the value of (C) in feet-per-second.

The resistance of the solid bodies depends not only upon their form but also upon the position that they occupy in respect to the air-stream. Thus, the resistance of a cone is greater with the pointed apex into the wind (Fig. 2) than with the flat base forward as in Fig. 3. The resistance is greater in the first place because the wedge-shaped end splits the air open wider than with the flat base forward and also for the reason that the pointed end fills the vacuous space better when the flat base is forward. The resistance coefficient (K) for these solids is in terms of miles-per-hour.

In Fig. 4 are tabulated a number of geometrical shapes with their corresponding coefficients of resistance. These figures are the result of actual tests of the sections made in a wind-tunnel and show a wide variation in the value of (K).

Just as a brief introduction to the subject, more of which will be explained later, a streamline body is a body of low resistance that passes through the air so that it causes the least possible disturbance in the way of eddies and turbulence. Their general form is indicated by (K) in Fig. 6 where the air is shown slipping smoothly over the body. As might be expected, the resistance coefficient is remarkably low. Much depends upon the proportions of such bodies in respect to the length-thickness ratio.

Wing Icing

(*Continued from page* 372)

means of four spray nozzles. This breaks the water up into tiny particles. The size of the drops are regulated by various combinations of air and water pressures in the nozzles.

Able thus to play Old Man Weather's game by making ice in any form desired and in every way that it is made by Nature, it was decided to test out the coatings.

Two kinds of compounds were used: One was the insoluble compounds, such as light and heavy mineral oil, grease paraffin and wax. The other kind was glycerine and molasses mixed with calcium chloride, hardened sugar solution, and a hardened glucose solution. These were brushed on the wings and wires and then various kinds of weather were turned on from the wind tunnel's refrigerator.

In the first tests it was found that oils, greases, and waxes showed no tendency towards prevention or even hindrance of the formation of ice. Many airmen had supposed that the drops of icy water would not stick to the oiled surfaces, but it was found that the water would freeze just the same no matter whether it was to grease or to the wings themselves free of oil. This eliminated the insoluble compounds.

The soluble compounds acted differently however. While they did not wholly prevent the formation of ice they did discourage the ice from sticking. The sugar solution kept the ice from blowing back. But the sugar solution was so thick—about like taffy candy—that it proved hard to handle and would be difficult to use. Glucose too had its disadvantages. But glucose, used at the suggestion of the engineers of the Bureau of Standards seemed to be a step in the right direction, since the ice was plainly discouraged from forming outward and so making flying difficult.

Glucose suggested corn syrup and this was used. It was found that under the cold wind carrying both fog and snow and a spray of water the corn syrup kept the ice from hardening and went the farthest toward preventing ice from sticking to the wings, wires, and struts.

The aviation engineers have concluded after a long series of tests using almost everything that could be suggested from soap and greases to sugar syrups that there is nothing that can be applied that will absolutely prevent the ice from forming if the weather is bad enough and long continued. Heavy greases, oils, waxes and paints did not stop the ice at all.

It was found, however, that hard soluble compounds such as glucose, and corn syrup which hold their shape and adhere strongly to the surface of the wings tended to keep the ice from forming if the temperatures did not go too low.

Thus it may be possible that the aviator having to fly in the winter time when the weather is unstable, will find it necessary to see that his machine is streaked with corn syrup. He will wish to see it serviced by a good application of syrup along the edges to keep the ice away.

Almost any hygroscopic material will assist to some extent since such bodies lower the freezing point. Examples are: glycerine, pectin, invert sugar, etc. But, whether they work or not, they are messy and not pleasant to use.

This study of weather is a notable one and will one day lead to the obtaining of the perfect flying plane able to come and go regardless of the whims of the gods of the upper air.

END.

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XUM

Winslow

(*Continued from page 364*)

ture. Douglas had got away first and Alan twisted up into the blanketing fog forty-five seconds behind him. He went up in a stiff left-hand spiral in order to save time. We stood on the ground, hearts pounding, listening to the ominous drone of the four engines and the shrieking whine of wires and struts. Our glances met and mutely asked the terrifying question: 'Which planes will come down first, Nieuports or Boche?'

"We waited. Minutes hung heavy upon us, like hours dragging into a day.

"Winslow and Campbell had to retell many times what occurred up in that murk. Doug saw a slim grey Pfalz D-3 about five hundred feet up and Campbell went to work on the flyer of the Maltese Cross, who by the way was a Pole who had flown for the Imperial German Air Forces for two years. He knew his stuff and half rolled away from Doug's flashing Vickers.

"Winslow had not made a half turn when, at about two hundred and fifty meters, he caught sight of an Albatross-5 Scout directly above and ahead of him. The two planes were not over one hundred yards apart when both pilots saw one another. The Hun had the advantage of height and came in a bee-line for Alan. Winslow pressed his gun trips and sent a scorching burst of lead through the mist. The Albatross pilot was experienced. He slipped into a left-hand reversement and came down with Spandaus blazing.

"The young American used his head and cleverly avoided the enemy fire by climbing in a right-hand spiral. He slipped off and came down directly behind and on the German's tail. Alan cut loose another long burst of between twenty and thirty rounds, which we could hear from the ground below. The Nieuport had greater speed than the Albatross and responded to the controls with the speed of lightning—but Alan had met a seasoned war-grilled adversary which equalized his machine's superiority.

"Suddenly a half-hysterical shout went up from the men on the ground. An Albatross came out of the low overhanging fog in a nose-dive. The pilot worked the controls skillfully and managed to get out of the crash alive. Almost behind the Albatross came the Pfalz engulfed in flames. Campbell came down to a wash-out landing but was unhurt. We didn't know who had shot down which, and, the truth is, we were so overjoyed that our lads had shot down both planes right on our field we didn't think much about who got the first victory then.

"Alan and Doug shook hands, congratulating one another, and there was a lot of back slapping. We were all like a bunch of school kids who had just learned the school house had burned down. We soon learned Winslow had won the first victory. His was the great honor of being the first American member of an all-American squadron to shoot down an enemy plane.

"WE ALL rushed over to the wrecked planes. Doug's victim had been thrown clear of the burning wreckage and was badly injured. Townspeople had come running out and surrounded the planes and there were a lot of French and American soldiers around Winslow's vanquished adversary. He was a poorly outfitted, scrawny German, a little man dressed in the rottenest uniform I ever saw.

"The man, who was now out of the show for good and facing ditch digging for the duration of the war as a prisoner, refused to believe the French soldiers when they told him an American pilot had shot him down. He didn't believe America had a squadron at the front, for which you can't blame him as it was our first day—our first three hours at the front, to be exact. We got some valuable information from the German, who, after a couple of American cigarettes which I gave him, seemed relieved the war was over for him.

"We each took a souvenir from the German planes, which were the first of 94's unequalled total of 69 victories. So did the spectators. Soon the planes were stripped bare to their framework. Later we were informed that General Gerard, Commanding Officer of the Sixth French Army, cited our heroes. They were awarded the *Croix de Guerre*, with bronze star. Our own Staff sent its congratulations, but neither Winslow or Campbell won a medal for that brilliant exploit from our government."

MR. RICKENBACKER paused for a moment, then continued: "July 31st, 1918, was a fatal day for the Hat-in-the-Ring Squadron. We lost McArthur and four of his flight. Our greatest loss that fatal day was Alan Winslow, the smiling boy from Chicago. We had moved up to the Chateau Thierry salient and did our share in blocking the German's last desperate push to capture Paris. The Boche had failed and were retreating. Opposing us were the celebrated Richthofen's *Jagdstaffels*—pilots with anywhere from twenty to forty victories, and Richthofen with many more, opposed our men, most of whom were not yet Aces. Winslow went down trying to get his third victory.

"Late in the evening of July 31st, Winslow was seen by a member of his flight locked in deadly combat with a Fokker. The two machines lost altitude during the struggle and the dusky ground swallowed both of them from view. That night we stood under the stars popping up Very lights in the clear sky. We hoped Alan would be guided back to the field.

"A month later one of my men met, in London, Alan's brother, Paul Winslow, a member of Great Britain's most famous squadron Number 56. Paul Winslow announced simply that Alan 'went west.' However, upon returning to his squadron a letter from Alan awaited him. Alan wrote from a German hospital, stating that he had become separated from his flight and had been wounded in combat with the Fokker.

"A bullet had slashed into his left elbow and he became unconscious from pain and loss of blood and crashed. Fortunately, with the exception of a few minor bruises, he was unhurt otherwise. At a German hospital his arm was amputated. Though there may have been gangrene in his arm when he reached the base hospital, he maintained amputation was unnecessary because proper medical attention was available immediately after his crack-up.

"Alan went through the hospitals and the prison camps. He never got over it. When he was released after the war, he came home through Russia. But when we saw him again, we did not see the Alan we had known so happily. His arm was gone, but it was the three months of wartime flying that had really changed this beloved character of the Officers' Mess into a man we scarcely recognized."

America's first ranking Ace concluded philosophically: "The sorrows, the surprises, the joys of war flying—they are legion! Winslow enjoyed a few joys and fame. But he had a fight on his hands from the day he went to war. Everything was stacked against him. I wonder why he—one of the finest men I ever knew—didn't have his chance."

END.

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Q & A

(*Continued from page 372*)

tion of balance corresponded to normal diving conditions which was usually quite unstable.

If, when in a steep dive, any attempt was made to increase the steepness of the dive, the plane became unstable and turned over on its back. This latter condition was called "Catastrophic instability."

* * *

QUESTION:—William Walters, Portland, Me. *Is there any simple way of determining the direction of a low pressure area or "cyclone?"*

Answer:—FACE the wind. The low pressure area or cyclone will then be at your right.

* * *

QUESTION:—Sam Klegal, Birmingham, Ala. *If the tips of a propeller are cut off, is the efficiency much reduced? For example, would it be permissible to cut off 4-inches from the tips of a 9-foot propeller?*

Answer:—TESTS have shown that cutting a small amount off the tips of a propeller reduces the efficiency only very slightly. For example, cutting a 10-foot propeller down to 9-feet only reduced the efficiency by less than 6 per cent.

* * *

QUESTION:—S. T. Adams, Brookline, Mass. *Does the centrifugal force tending to burst a rotating part increase very rapidly with an increase in the speed?*

Answer:—CENTRIFUGAL force increases as the "square" of the speed. Doubling the speed increases the force four times. Therefore, care should be taken in speed variations to avoid the danger of bursting the part.

* * *

QUESTION:—Thos. H. Battle, Philadelphia, Pa. *If the total resistance of a plane is known, is it possible to calculate the horsepower?*

Answer:—MULTIPLY the drag in pounds by the velocity in miles per hour and then divide this product by 375. This will give the power actually required for propulsion in horizontal flight. The engine power is then obtained by dividing the result by the propeller efficiency, a safe figure being 0.70. To this horizontal flight power must be added sufficient power for climbing.

This, the h.p. for horizontal flight is now subtracted from the total available engine power to obtain the value of the horsepower reserve for climbing. Multiplying the reserve h. p. by 33,000 and dividing by the weight of the plane will give the climb.

END.

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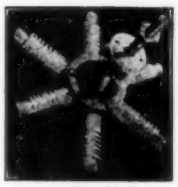
Model Ready to Fly.....$17.50



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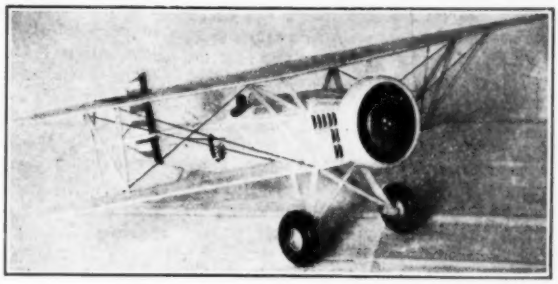

24" Span. Weight 1¾ oz. Flies 900 Feet.

A finely detailed model, practically crashproof. Set includes 3" celluloid motor, aluminum motor plate and drag ring, balloon celluloid wheels with silver discs, printed instrument board, fuselage, wing and rudder insignia, aluminum pilot's seat, dope, glue, drawing and all materials. Special Fibre propeller.
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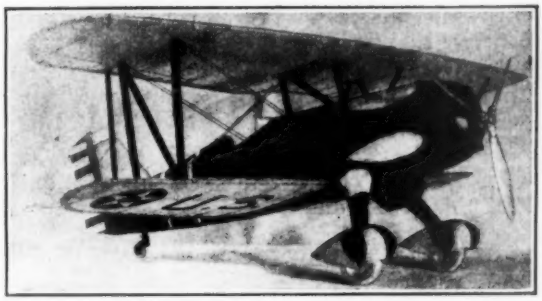
Model Ready to Fly.....$18.00

CURTISS ARMY HAWK P6E



24" Span. Weight 2¼ oz. Flies 800 Feet.

This new improved model of the P6E is the strongest and most perfect to be had; it is practically crash proof. Set includes: ribs, fuselage formers, radiator, wing tips, wheelpants, printed on balsa. Strong aluminum wheels, tail wheel, hollow metal exhaust pipes, wing, rudder, fuselage and U. S. Army insignia's, printed instrument board, turned nose plug, formed prop shaft and motor hook, semi-scale fibre propeller, yellow and drab dope, glue, detail drawing with squadron design for fuselage and wheelpants. Set comes in colored labeled gift box sealed.
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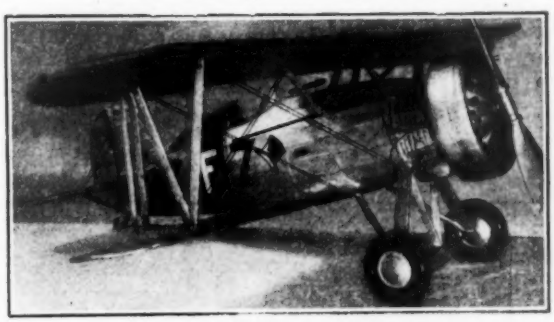

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Levitation

(*Continued from page 370*)

opinions up to the time that you wrote the article on Levitation. I am sorry that I cannot agree with this story also.

This is the way I look at the matter. To lift a weight we must cause a continual acceleration of a body and this would mean that we must continually accelerate and accelerate until we reached an infinite acceleration! This primary fact, of course, would put the idea of Levitation out of the running.

Tut, tut, Mr. Taylor. If we finally arrived at an infinite acceleration we would thereby produce an infinite force—something that we would not desire even though it were possible. We require, on the other hand, a continual lifting force produced by a constant acceleration such as would be created by a constant acceleration of a series of bodies or by the uniform acceleration known as centrifugal force.

You will no doubt agree that a constant force is generated by swinging a weight in a circle at a constant speed, and at no time does this approach an infinite acceleration.

* * *

PICKING up the letter of Arthur Cumberland, Troy, N. Y., we find that the writer has given quite a bit of thought to the subject and has devised an arrangement roughly represented by Fig. 4. This is a centrifugal force device that deserves a tryout.

Glad to see that you are so progressive and that you are not afraid to express your opinion, though I'll bet that you got a lot of hot letters from the stand-patters and other fat-heads who can't see how anything can work unless it is being sold on the market.

Now, I have thought out a scheme (not tried) which is based upon differential centrifugal forces. I'm so hot on this idea that I'm going to try it out. In my sketch (see Fig. 4), I have a track arranged with the large radius curve at the bottom and the short radius at the top. The arcs are connected by straight tangents.

Now, pulling out the old handbook, we find that the centrifugal force is expressed by $C=WV^2/gr$. There's not much that we can do with the weight (W) nor the velocity (V), nor yet the gravity (g), but we can vary the radius (r) as shown in the sketch. This formula shows us that decreasing the radius increases the centrifugal force, so I have made the top radius ($r1$) about one-third the bottom radius ($r2$).

As a result, the upward force ($F1$) tending to cause lift, will be three times as great as the downward force ($F2$). Further, the energy absorbed by going around the short sharp curve should slow the weights down so that the velocity is reduced at the bottom with a further decrease in the downward component.

This looks pretty good—pretty good. It might work, too, unless some unforseen contingency arises that would cancel out the lifting force. I'll be sitting on a hot seat until I get word from you as to how this experiment turned out.

* * *

JAMES L. KUEGEL, Duluth, Minn., gets hot under the collar when he even thinks of an obscure person like myself daring to suggest something new. As he only calls me names, without bringing any lucid or logical argument against the proposed idea, I can't make much of a reply.

Criminy Cripes! Four good pages of P. A. wasted on a lot of half-cooked baloney that even a high-school kid would laugh at. When an improvement on the present successful airplane is invented, it will be by a real guy and not some hooey editor. Go and lay down in your corner.

For a long time, P. A. has been giving us good dope on aviation and about real airplanes that fly—not a lot of pipe dreams. And then this bunch of junk has to be run in, to spoil it all.

Well, well, I didn't think that it was as bad as all this. I received several letters of this same general nature, though this is by far the most abusive of them all. It is the age old story of public resentment against new ideas.

* * *

HERE is a letter from George Strakos, New York, who claims that he has had successful results—so successful in fact that he has applied for a patent on his invention.

In the August POPULAR AVIATION, *I saw a description of something on which I have been working for a long time. About four years ago I first got the idea which has been worked out. Because I have just entered my application for patent, I can not show how it works, but as soon as patent is granted I will tell you all about it.*

With a quarter horsepower motor I lifted 55 pounds in the air about ten feet above the floor. I have many witnesses to this. It is very easy to understand but dam hard to figure out, because I am a fruit merchant and not an aviator or engineer.

This is something, take it from me. If this idea is as successful as claimed, Mr. Strakos has the world in the palm of his hand. I hope that we will get the dope at an early date because there are about 100 skeptics standing in line to hear the news.

* * *

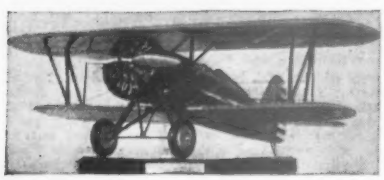
THEN comes another criticism, witticism or what have you. Mr. Albert Schnoor is really getting concerned about my health.

I know an editor has a tough job and the job is a big strain on his nerves. Besides the weather was very hot all summer and you probably suffered with the heat. So, considering all these causes, I will forgive your article on Levitation.

O.K., Mr. Schnoor. What you say is quite true and I'm going to get a test made to see if my I. Q. is still above 4.00. Thanks for your forebearance and forgiveness.

END.

20" BOEING P-12-E



Photograph of the Boeing P-12-E Model

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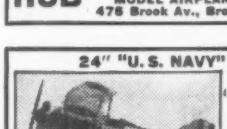

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1/32x1/16.3,	2c	1/64 x2...1,	6c
1/16x1/8 .3,	4c	1/32 x2...3,	14c
3/32x3/32.3,	4c	1/16 x2...3,	18c
1/8 x1/8 .3,	6c	3/32 x2...3,	18c
1/8 x3/16.3,	6c	1/8 x2...3,	20c
1/8 x1/4 .3,	8c	3/16 x2...3,	24c
1/4 x1/4..3,	12c	1/4 x2...3,	30c
1/2 x1/2..3,	20c	1/2 x2...1,	15c
1 x1 ..1,	16c	1 x2...1,	25c

3/8x 1/2x 5	2c
1/2x 3/4x 6	3c
3/8x 3/4x 7	3c
5/8x1 x 8	4c
3/4x1 x 9	5c
3/4x 9/8x10	7c
3/4x 9/8x11	8c
5/8x 5/4x12	8c
1 x 3/2x14	14c
1 x11/8x16	15c

No Order under 30c accepted. Price P.P. or at Dealers

WOBURN MODEL AIRPLANE SHOP
17 Belmont St., (Dept. F) Woburn, Mass.

6 Ft. "FlexRigid" Steel Rule Tape, coiled in a nickel plated case. Serves as a rule or steel tape. *Fits in the vest pocket.* Ideal for Model Builders and Mechanics. Only 50c Postpaid.

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NEW BOEING TRANSMISSION - $1.00
No Gears! No Pulleys! No Belts!

Now you can make successful FLYING models of the Boeing Transport, Boeing Bomber, and other multi-motored planes. Three separate strands of rubber enclosed in the fuselage run the two props at exactly the same speed. No special winder is needed. It is designed for models of about 24" wingspread and weighs only ¼ ounce. Postcard brings circular of this and other types of transmissions. Dealers write for discount.

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UNPATENTED IDEAS CAN BE SOLD

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Get your start in the fast growing
COMMERCIAL AVIATION INDUSTRY

New Ocean routes soon starting. America's fastest growing Industry. Our booklet "Wings of Commerce," lists over one hundred different occupations in this field, salaries paid, apprenticeships, promotions, how to qualify and apply. Lists all Airline Companies in U. S., Canada, Mexico, Central and South America. Information is complete. Price 20c postpaid.

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QUALITY BARGAINS

Balsa 18" lengths

1/16x1/16.....50 for	5c
1/8 x1/8.....25 for	5c
1/8 x1/4.....14 for	5c
1/32x2".....3 for	5c
1/16x2".....3 for	5c
1/8 x2".....2 for	5c

Clear Cement. 2 oz 10c
Wheels, 1", pr. 3c;
1½" 4c
Jap Tissue, 1 doz....20c
Bearings, l. or s. doz. 10c
Dopes, clear or colored
Berryloid, 2 oz.....10c
Add 15c for postage

Send 3c for price list and free gift

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Terms reasonable. Personal attention.

Send model or drawing for FREE advice.
Book "HOW TO GET YOUR PATENT" sent on request

L. F. RANDOLPH
REGISTERED PATENT LAWYER
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Marvellous New Engineering System for Model Aircraft

Now makes it possible to construct huge model airplanes from one ounce to FIVE POUNDS. Vast scope in helping you to use your own originality. Ideal for experimenting inventors. Greatest boost ever offered model aviation. 10c coin pasted on letter brings information.

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Model Aircraft Engineer
Dept. A, 2121 Wellington St., Montreal, Canada

60c BALSA WOOD 60c

Why bother ordering a lot of different sizes. Send 60c for one of our assortments and obtain plenty of the various sizes to build several models. All 18" uniform lengths—Best grade Balsa, especially selected for model building.

No. 1—For all ordinary model building
No. 2—For finer and more experienced work
Order by Number 60c Postpaid

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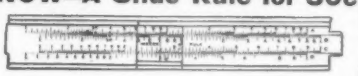
MISCELLANEOUS

Work your way into
AVIATION

Send $1.00 for Application Blank, List of Airmail Operators, Air Lines, Factories and Airports, where hundreds are now employed.

Aviation Service Co.
3433 Mohawk St., Lincoln, Nebr.

NOW--A Slide Rule for 50c



Six inches long in genuine leather case with instruction booklet. Celluloid rule in metal frame-will not warp-constant friction. Send money order (no stamps) for 55c to receive an indestructible slide rule at one-fifth ordinary costs!!

INDECO 239 John St. Bridgeport, Conn.

PARA RUBBER Always Fresh		JAP SILK TISSUE White 3c per sheet	
1/32 sq.....2 ft.	1c	Red, green, blue, black,	
3/64 flat.....3 ft.	2c	orange, brown, yellow,	
1/16 flat.....1 ft.	1c	5c per sheet	
3/32 flat.....1 ft.	1c	Extra thin tissue 6c sheet	
1/8 flat.....1 ft.	1c	Straight Music Spring Wire No. 5, 6, 8, 10, 12,	
3/16 flat.....2 ft.	3c	14, 16, 18.....2 ft.	1c

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WRITE at once for our wholesale list . . . Everything for the Model Airplane Dealers and Clubs.
Get Right by Writing!

Balsa Wheel Company
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E-X-P-L-O-R-E!

Boys, own a complete Junior Scientist Microscope set. With this outfit you can see new world's invisible to the naked eye. Complete outfit with microscope only $1.98 Post paid. SPECIAL FOLDER WITH FULL LINE OF MICROSCOPES, TELESCOPES, CAMERA and sporting Goods only 10c.

M. MILLER
530 Parkside Ave., Brooklyn, N. Y.

Polished Duraluminum Motor Plates		Drag Rings Cowlings	
For 1¼" Motor....	8c	1¼" diam.....20c	..20c
For 2" Motor....	10c	2" diam.....25c	..25c
For 2" Motor....	12c	2¼" diam.....28c	..30c
Aluminum Tubing		3" diam.....30c	..35c
1/16 O.D. 6" 8c	1 ft. 15c	**Aluminum Sheet**	
3/32 O.D. 6" 8c	1 ft. 15c	.006....72 sq. in.	....13c
1/8 O.D. 6" 8c	1 ft. 15c	.008....72 sq. in.	....15c
3/16 O.D. 6" 9c	1 ft. 18c	.010....72 sq. in.	....17c
		.013....72 sq. in.	....25c

Prices P. P. or at Dealers

WOBURN MODEL AIRPLANE SHOP
17 Belmont St., (Dept. F) Woburn, Mass.

LATEST NOVELTY CLOCK
The lifelike model of a nine cyl. aeroplane engine.
BEAUTIFUL ORNAMENT for office and home.
Ideal gift for graduations bridge prizes, etc.
made of metal—height 6 inches model B windmovement...$3.55 model C electr. movmt. AC $3.95 (guaranteed money back if not satisfied)

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VALVES
Sticky?
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PYROIL
Simply add to Regular Oil!
Says Allen Flying Service, Pyroil increased revs. 80 R.P.M. or 15 H. P.— reduced oil consumption 50%. Write for trial test offer. Mfr'd., Pat'd. Guar'd by
PYROIL CO.
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CLEAR CEMENT

Small Bottle 5c | Large 6" tube 16c | Extra Large Bottle 40c

Clear Dope, Acetone or Banana Oil, small bottle 5c Medium, 10c; Extra Large, 40c; Colored Dope: Red, White, Blue, Green, Yellow, Olive Drab, Black, Silver, Orange, Brown and Grey. Small bottle 5c Medium, 10c; Extra Large, 40c
Prices P. P. or at Dealers

WOBURN MODEL AIRPLANE SHOP
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BUILD A FRONT DRIVE!

The details of construction of a **Real Baby Front Wheel Drive Auto** as this are now in blueprint and available to you. This car powered by a 4-cyl. motor is made of old car parts as Model T, etc. all so cheaply obtained now, and **best of all a machine shop is not a necessity** for making such a fast one. Send stamp for further details.

Edw. A. Bornstreager, 3450 N. Marshfield Ave., Chicago, Ill.

"NEW DEAL" for LIGHTPLANE BUILDER and OWNER

Write Today
For Free Bargain Circular

Sportsman Airplane & Supply Co.
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CELLULOID WHEELS		DUMMY MOTORS	
¾" diam.....10c	Pr.	1¼" diam.....	25c
1" diam.....12c	Pr.	2" diam.....	35c
1⅜" diam.....15c	Pr.	3" diam.....	45c
1⅞" diam.....25c	Pr.	**CELLULOID SHEET**	
PANTS FOR		2 x 6.....1 for	4c
¾ or 1" wheels 30c	Pr.	**CELLULOID COWLING**	
1⅜ or 1⅞" ...40c	Pr.	2¼" diam.....20c	ea.

PRICES P. P. OR AT DEALERS

WOBURN MODEL AIRPLANE SHOP
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Attention Model Builders

Send 25 cents in coin for set of drawings and description on how to build a Dual Propeller Rubber Band Motor for your models. This can be put on or built-in most any model. This motor eliminates Torque. The motor itself will fly straight up. I will also send Picture and Description of New Type Airplane using Dual Propellers.

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WHAT? A BRAZING TORCH FOR $10.00

Yes, but only volume production will warrant such a low price for this high grade, all brass constructed torch. No cheap material goes in the construction of this torch! You can do the work that before could be done with costly welding torches. You can Braze, Silver solder, and do light welding with this torch. Do your own brazing and silver soldering and save the difference! Information 5c.

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Good Opportunities for Our Swappers

The publishers reserve the right to reject any or all notices that are not in accord with the policy of this magazine. Only trades or "swaps" will be permitted. For cash deals, buying or selling, refer to our Buyer's Directory. Readers are urged to use caution in arranging trades and references should be mutually exchanged.

AIRPLANES

HEATH PARASOL, less engine, 35 h.p. Anzani Engine and prop, helmet, goggles, aviation books and magazines. What have you?—J. Marek, Jr., Ashley, No. Dak.

MONOPLANE, single place, low-wing hydroplane, welded fuselage, 2-cylinder 28 h.p. engine. Fuselage and wings uncovered. All brand new and built by a licensed mechanic. Want good metal turning lathe, motorcycle or shop equipment.—McCoy Aircraft Service, Napoleon, Ohio.

AIRPLANE WANTED, a good 2-place or 3-place ship, must be in good flying order. I will trade the following articles for it: One SR-45 16 h.p. Johnson racing type motor, one 14-foot utility boat, one 11-foot step cut racing boat (Fair condition), good trailer and Acx. One model T Ford pick-up truck (fair condition).—Address answers to P. O. Box 591, Summerville, S. C.

LINCOLN STANDARD J-1, Identification No. 7717, in flying condition. I want a 1-place job and it must be in good flying condition.—S. Gardner, Burton, Nebr.

EAGLET, in like-new condition. Will trade for a very late model car. Want Franklin Sport Airplane less engine.—Wallace Ang, 1010 8th St., Rockford, Ill.

OXX6 CHALLENGER C-2, 250 hours total time on it, 10 hours since last overhaul. Has all instruments, speed 105 m.p.h., 3-passenger, pressure fire extinguisher, like new, will trade for a cabin cruiser, Ketch, Yawl or anything of equal value.—Jack Remsen, 769 Hunterdon St., Newark, N. J.

RETZ MONOPLANE, Type R4, 2-place open, Rathel 50 h.p. "In-line" air-cooled engine, metal prop, new Clark "Y" wings, in real shape. Will trade for a light car.—Retz R8, 1-place biplane, less engine and wheels.—Robert Retz, Farmland, Ind.

LIGHTPLANE WANTED, a motorcycle, typewriter, glider, 16 m.m. movie machine or an outboard. I have a set of drums, Hinton's course on aviation, trumpet and case, about 50 magic tricks in case and other things to swap.—William Jeffries, 30 John St., Sheatown, Nanticoke, Pa.

SWALLOW TP TRAINER in excellent condition and licensed until July, 1933. I will trade it for another plane or will accept crackup toward trade. What have you? I also have a quantity of Simplex ailerons, steel tubing and other equipment to numerous to mention; that I will swap.—Lee Aircraft Co., Napoleon, Ohio.

LIGHTPLANE WANTED, preferably an Aeronca C-3 or Cessna 2-place. Will trade a 1928 Chevrolet coupe in A-1 condition and some cash.—Edward Henkel, Athol, Kansas.

OX-5 SWALLOW, engine just overhauled, fuselage in good condition, airspeed indicator, top wings need repairs. I have all material for repairing. Will trade for a lighter plane or good air-cooled engine. Plane in Minnesota.—C. A. Proctor, Hdqs. Sqd., Chanute Field, Ill.

AIRPLANE WANTED, a new production job, preferably a new Gates Day Standard. I have a 1928 custom built Packard Phaeton, 1927 Chrysler Roadster, a 1930 sports roadster with $110 worth of extras.—Thomas Cushman, 518 South 8th Ave., Maywood, (0) Ill.

LIGHTPLANE WANTED, must be in flying condition. Prefer a Heath, Aeronca or Vernelli Air Coach. Will trade a late model Chevrolet roadster in good condition and might pay a cash difference if a bargain.—Conley, Collins, Lee Valley, Tenn. (0)

AIRPLANE SUPPLIES

AIRSLED FUSELAGE, 3-place uncovered truss frame with accessories. Can be adapted to airplane use. Will trade for a Harley-Twin or Indian Scout motorcycle.—Robert Schwind, Grafton, Mass.

A CHARGE of one cent per word will now be made for all advertisements entered in the Barter and Exchange columns. Please enclose remittance on this basis when submitting copy.

POPULAR AVIATION
608 S. Dearborn St.,
Chicago, Ill.

WINGS WANTED for 1929 Velie Monocoupe or complete Monocoupe less engine. I will trade a 1932 Harley-Davidson motorcycle or what do you want?—Emil Magnuson, Backoo, No. Dak.

THOMAS-MORSE PARTS, light wood fuselages, wings, tail surfaces, one brand new 8'-0" four bladed propeller (never drilled) having a value of $250, a bank-and-pitch indicator (also new), etc. Will trade for most anything. What have you?—Karl Anderson, 109 E. Green, Ithaca, New York.

PIETENPOL STEEL FUSELAGE with seats, instrument board, turtle-back, Ford Engine mount, dual controls, I will trade it for a 1927 or 1929 Harley-Davidson motorcycle in good running condition.—George Clement, Route 7, Box 35, Louisville, Ky.

AIR-CAMPER RIBS, 1-set with blue-prints, to trade for a Heath wing complete.—H. A. Sommers, Ewen, Mich.

LANDING GEAR FITTINGS, wires and axle of a Lincoln Standard. Will trade for a small engine that is suitable for a glider.—A. Jones, Schertz, Texas.

USED WING, 35-A airfoil, 32-foot span, 5-foot chord, aluminum leading edge, gas tank installed in wing, control tubes inside, cover O.K. Also two 20 x 4 clincher wheels, Wheel Pants, pair to fit 20 x 4 wheels. Propellers:—2 Ford A, 1 Henderson, 1 Harley-Davidson pusher, 2-3-foot four bladed props for H. D. and Indian powered ice-boats. What have you?—Robert Retz, Farmland, Ind.

AUTOMOBILES

1928 PONTIAC COUPE, A-1 condition, new tires. Will trade for Rearwin lightplane or an Inland Sport Plane, or what have you?—H. R. Yost, Cummings, Kan.

MIDGET CAR WANTED. Will trade a 24 h.p. Johnson outboard engine in good condition. Car must be in A-1 condition. I also have other things to trade. Write me.—Lewis Penn, Jr., Washington Valley Road, Morristown, N. J.

ENGINES — ACCESSORIES

FRANKLIN-SIX, air-cooled, factory converted. In perfect condition but without prop. What have you to trade? Photo 10 cents.—M. Carpentier, 771 High St., Aurora, Ill.

MOTORCYCLE ENGINE WANTED, 2-cylinder type or a lightplane engine. I have a Swiss watch, radio, radio parts, speedometer, magazines, small grinder, water skiis and many other things.—J. Britton, 134 Riverside Drive, Binghampton, N. Y.

AIRPLANE ENGINE (SMALL) WANTED. Have for exchange, a Harley-Davidson, 2-cylinder engine equipped with a thrust bearing and a 51-inch propeller suitable for an ice boat.—R. H. McKinney, Holmes Building, Hannibal, Missouri.

HENDERSON AIRCRAFT ENGINE, in A-1 condition. I will exchange it for flying instructions or a late model Harley-Davidson motorcycle. I also have altimeters, switches and inclinometers. Will exchange them for helmet, goggles; hunting, fishing, camping or sporting equipment.—A. Courtines, 10 E. Green St., Johnstown, N. Y.

BICYCLE ENGINE WANTED. 1-h.p. Will trade a Slingerland Snare-drum, both heads practically new. I also have plans for a 2-foot Sirius and photos of the Stinson air-liner, Boeing 247 and late transport planes.—Jack Dunsworth, 4218 Harriet, Minneapolis, Minn.

OX5 ENGINE, complete and in good condition, and also airplane instruments. Will exchange for garage shop equipment or what have you?—Selmar Skatrud, Valders, Wis.

LeBLOND ENGINE, 60 h.p., Serial 5D-551. Will trade for a Model A Ford.—Frank Powell, Box 472, El Dorado, Kansas.

FORD "A" ENGINE in perfect condition. Excellent for lightplane or boat conversion. Also an Oakland 6-54 engine. Will trade either for an outboard or 4-cylinder air-cooled engine and transmission, or late motorcycle in running condition or midget car parts.—Robert Bower, 147 Centre St., Brooklyn, N. Y.

SMALL ENGINE WANTED. I have many things to trade for the engine. What have you?—A. Jones, Schertz, Texas.

AIR-COOLED ENGINE, 9-cylinder, 80 h.p. Will swap for a single of any make.—A. Jones, Schertz, Texas.

PARTS for OX, Liberty, Hisso, LeRhone 80, 180 D. H. axles, Jenny landing gear, Jenny wheels and wings, new spark plugs for rotary engines, magnetos, supplies. Will trade for any of these for a small engine.—A. Jones, Schertz, Texas.

WANTED, a washing machine or bicycle engine in fair condition. Have complete erector set No. 7, 12 copies of Boys Life, also 12 volt spotlight.—C. Philbrick, 204 Toro St., San Luis Obispo, Calif.

GLIDERS

NEW GLIDER. I want a motorcycle.—A. Jones, Schertz, Texas.

GLIDER, 2-place, dual controls, to trade for a lightplane. Welded steel fuselage, 35-foot span, 5-foot chord, identification No. 715. Would like a Heath but will consider any plane.—Ray Swinton, Shelby, Mich.

PRIMARY GLIDER, 2-place, dual control, ideal for instruction. Nearly new, a sure flyer and factory built. I will trade it for light power wood or metal working machinery, such as Delta, Boice-Crane or a small lathe.—Ray Swinton, Shelby, Mich.

GLIDER, No. 16702. Successfully flown for two years, now stored and needs some repairs. Will trade the glider for an outboard engine.—Dr. deHesse, 2544 E. 79th St., Chicago, Ill.

MISCELLANEOUS

YOUNG MAN, age 19. Can talk, read, write, translate and typewrite English, Spanish and French. Will exchange said services for flying instruction or will perform any stunt for barnstorming outfit.—Othniel Rugs, 40 Gaven St., San Francisco, Calif.

STAMP ALBUMS WANTED, with stamps. Have many magazines, three aviation books and an 18-inch Polish Fighter.—Joseph Zishka, Nortonville, Kansas.

OVER 100 useful radio parts, transformers, shortwave coils, condensers, dynamic and magnetic speaker, meters, dials, resistances, etc. Will trade for a binocular, movie camera outfit, tools, motors, airplane books or what have you? Will send a descriptive list of parts on request.—Arthur Stoltman, 275 Martense St., Brooklyn, New York.

No. 7 GILBERT ERECTOR SET, value $10. Complete, practically new, packed in red and black trimmed special wooden chest. Will trade

XUM

or sell. Especially desire stamp collection, wrist watch, guitar or books.—Earl Miller, 419 E. Walnut St., Lewistown, Pa.

30 AIRPLANE STORY MAGS, 50 adventure and detective story magazines to trade. What have you?—Bert Adams, 1911 S. 11th Ave., Maywood, Ill.

$165 BARITONE, $45 Civil Service Course, Evans glider plans, Winchester repeating rifle, I want a typewriter, craftsman's tools, lightplane engine, lightplane parts.—Sterling Hostettler, Topeka, Ind.

10 HIVES BEES (C), full depth supers (new), a "23" Ipdian motorcycle in A-1 shape, Nos. 1 and 5 Chemcraft sets (new), also many other things. Want late model motorcycle or what have you?—Bob Gagnon, Buena Park, Calif.

TYPEWRITER, lathe. Also Aviation course, high-school course and mechanics course. Books, radio parts, stamps, etc. I want a good target revolver or automatic.—Donald M. Copeland, 2298 Priscilla St., Saint Paul, Minn.

MAGAZINES, 41 issues of Aero Digest, from May 29 to October, 1932. What have you?—Hubert Clark, R. R. 4, Newton, Ill.

WATCH. What will you trade for new $65 Illinois, 21 jewel (Bunn special) railroad watch? —Russell Agnew, 614 So. 12th St., Burlington, Iowa.

DAYTON AVIATION COURSE, complete, with loose-leaf binder for the lessons. Also a ten lesson radio course with illustrated plates. Will trade for a glider or motorcycle. I also have many aviation magazines which I will trade for aviation books or pictures.—Charley K. Bergstrom, R. R. 2, Cuba, Kansas.

MOTORCYCLES

INDIAN CHIEF MOTORCYCLE, and a 1-cylinder Gray marine engine with a 3-bladed propeller. Will trade for a plane in any condition.—Chester M. Ziegel, R. D. 2, Box 91, Beaver Falls, Pa.

HARLEY TWIN motorcycle wanted, 1928 model at least. Must be mechanically O.K., or else a Model A Ford car. I have a homebuilt Mead Primary Glider, good workmanship, flies well.—Joe Hobzek, 4452 W. 53, Cleveland, Ohio.

MOTORCYCLE WANTED. Model 1930-32 Twin. Must be in good running condition. Will trade 13 ft. cabin outboard hull. All equipment. Never used, excellent condition.—Paul Bauer, 234 Palisade Ave., Bogota, N. J.

MUSICAL INSTRUMENTS

HAWAIIN GUITAR COURSE, cost $35. Will trade for a good make of tenor banjo.—Russell R. Allen, 3007 Edmond St., St. Joseph, Mo.

CLASSIFIED

PATENT Your Invention—"Little Ideas May Have Big Commercial Possibilities." Send for free book. "How to Obtain a Patent and Record of Invention Blank." Prompt service. Highest references. Reasonable charges. Deferred payments. Established 1898. Victor J. Evans & Co., 790M Victor Building, Washington, D. C.

USED Airplanes $85 and up. Literature 10c. Federal Equipment, Deerpark, Ohio.

BIG MONEY Applying Gold Initials on Automobiles. Easiest thing today. No experience needed. Free Samples. "RALCO," 1084 Washington, Boston, Mass.

MOTION PICTURE Bargains. News reels $2.25, odd reels $1.50. Bargain lists. Hoffman Film Service, 57 Broad, Albany, N. Y.

SONGWRITERS! Poems, melodies. Amazing opportunity. Hibbeler, D109X, 2104 Keystone, Chicago.

Aero Books

If you are looking for a suitable Christmas gift for an air-minded friend, buy him or her an aviation book. We have a great many to offer, dealing with all aviation subjects.

POPULAR AVIATION

608 S. Dearnborn St., Chicago, Ill.

Book Dept.

Douglas DC-1

(*Continued from page* 377)

by a frame of welded steel tubing. The engine mounting, the oil system and parts in front of the firewall of the nacelle are quickly and easily detached and interchangeable—right and left. The engine is mounted through rubber bushings which reduce the amount of vibration transmitted to the airplane structure. A pressure fire extinguisher system, controlled by a selector valve, can direct the extinguisher fluid into either of the engine nacelles.

A very roomy cockpit with excellent vision is provided for the pilot and co-pilot and has been specially designed with a view of eliminating reflections and glare. It can be reached through a door from the passengers' compartment and also through a hatchway, the latter also serving for observation and navigation.

The controls are of the dual type having individual wheels and pedal foot controls. The control column is placed next to the fuselage so that it does not interfere with the crew getting in or out of their seats and are connected internally to the control surfaces. A very complete instrument equipment is provided with the instruments well placed and carried on a rubber mounted instrument board that eliminates the greater part of the vibration from the delicate instruments.

The retractable landing gear is operated by a single hydraulic system by which the pilot can retract the wheels by means of a pump. The landing gear is so balanced that it can also be operated manually, and when in the retracted position, the wheels enter the engine nacelles. It is interesting to note, that in case of trouble with the retraction gear, that the plane can be landed on the wheels while in the retracted position without injury to the ship except for possible damage to the tips of the propellers. Visible and audible warning devices record the position of the wheels so that the pilot at all times can determine the position of the landing gear. The tread of the main wheels is 18 feet, the wheels themselves having 42 x 15 inch tires.

SPECIFICATIONS OF DOUGLAS DC-1

Wing span	85'-0"
Length	60'-0"
Height overall	16'-0"

WING DETAILS

Wing root chord	14'-3"
Wing tip chord	5'-8"
Wing area	940 sq. ft.
Wing incidence	2 deg.
Wing dihedral	5 deg.
Mean aspect ratio	7.70

WEIGHTS AND LOADING

Weight empty, incl. equipment	11780 lbs.
Gross weight	17,500 lbs.
Useful load	5,720 lbs.
Total normal payload	3,400 lbs.
Weight per horsepower	12.3 lbs.
Loading per square foot of wing	18.6 lbs.

PERFORMANCE

Top speed at 8,000 ft.	210 m.p.h.
Cruising speed at 8,000 ft.	186 m.p.h.
Landing speed	60 m.p.h.
Rate of climb at 8,000 ft.	950 f.p.m.
Service ceiling	23,000 ft.
Cruising range, 500 gals. gas	1,200 miles

One noticeable feature is the clean cut undersurfaces which are perfectly smooth and devoid of any openings when the landing wheels are fully retracted and in place within the nacelles. The tail wheel is the only visible part of the structure when the ship is in full flight. This is distinguished from many other ships with retractable gear which have large openings on the wings after the wheels are retracted.

END.

Autogiro

(*Continued from page* 399)

ROTOR ASSEMBLY

MAKE the rotor support of 1/16 inch dia. pine dowling. The height above the fuselage is 1¼ inch. Also set a piece of 1/16 inch dia. aluminum tubing at a four degree angle in the two pieces of 1/16 inch balsa and cement it in place.

The leading and trailing edges of the rotor blades are both 1/32 inch sq. bamboo, which give flexibility and strength. The tips are 1/16 inch dia. reed, and a ⅛ inch block of balsa is cemented on at the hub end.

The hub is very easily constructed by following the steps of the diagram on plate three.

Push the blades on the aluminum tabs of the hub at a two degree angle of attack (negative) and cement. The rotor post is formed of heavy music wire.

Make four wire eyes and cement them to the center of the second rib of each blade. Rig thread from the post, and between each blade as shown in the photographs. Don't forget to cement a washer at both ends of the rotor post, so the rotor will stay on while the plane is in flight.

REMEMBER—

Don't paint the model, as it will be too heavy to fly properly.

That everything must be accurate, because a warped part will mean a crackup.

To launch the model by hand or R. O. G., making sure the rotors are turning ANTI CLOCKWISE at least a little, before launching. And do not fly the model in a wind.

The motor only needs about a hundred turns.

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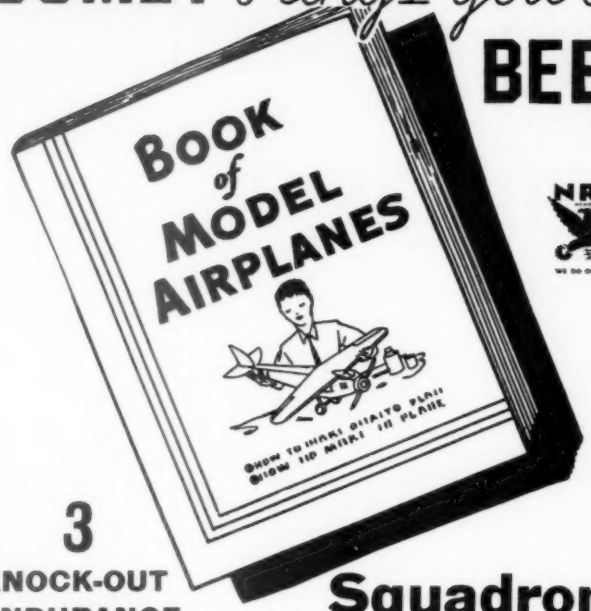

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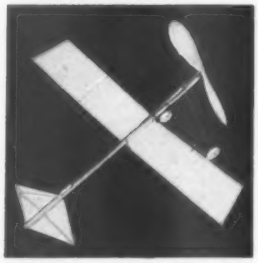

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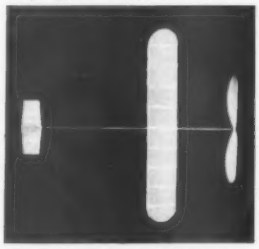

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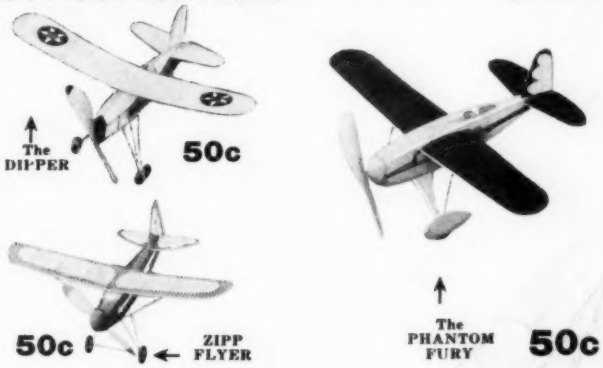

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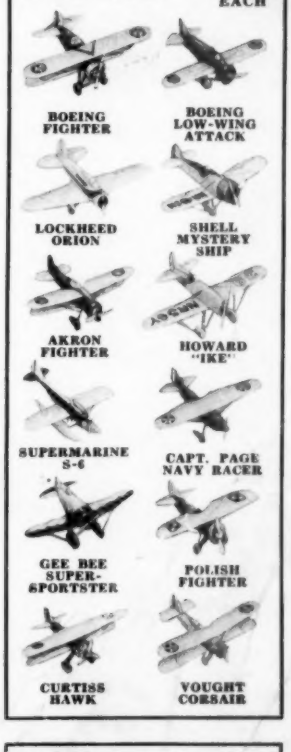

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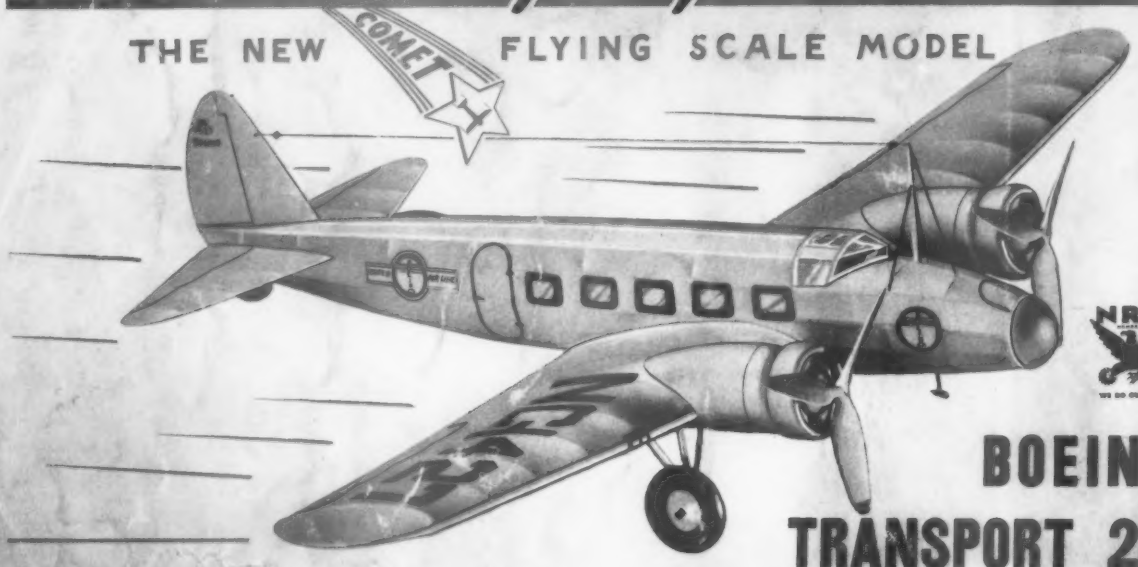

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